Duke University Libraries
D02307214J

DUKE
UNIVERSITY

LIBRARY

Copyright by
KHWAJA MUHAMMED SULTANUL AZIZ
1966

Duke University Library

The use of this thesis is subject to the usual restrictions that govern the use of manuscript material. Reproduction or quotation of the text is permitted only upon written authorization from the author of the thesis and from the academic department by which it was accepted. Proper acknowledgment must be given in all printed references or quotations.

FORM 412 1M 11-43

ACROCHAETIUM AND KYLINIA IN THE SOUTHWESTERN NORTH ATLANTIC OCEAN

by

Khwaja Muhammed Sultanul Aziz

Department of Botany
Duke University

Date: June 6, 1964

Approved:

Harold J. Humm

Harold J. Humm, Supervisor

Jane Philpott

Donald E. Stone

T. W. Johnson, Jr.

J. E. Gray

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department of Botany in the Graduate School of Arts and Sciences of Duke University

1965

ACLOSPERMUM AND KYLINIA IN THE SOUTHWESTERN NORTH ATLANTIC OCEAN

by

Khwaja Muhammad Sultanul Aziz

Department of Botany
Duke University

Date: January 6, 1954

Approved:

Harold J. Humm, Supervisor

A dissertation submitted in partial fulfillment
of the requirements for the degree of Doctor
of Philosophy in the Department of Botany
in the Graduate School of Arts and
Sciences of Duke University

1955

ABSTRACT

ACROCHAETIUM AND KYLINIA IN THE SOUTHWESTERN NORTH ATLANTIC OCEAN

by

Khwaja Muhammed Sultanul Aziz

Department of Botany
Duke University

Date: June 6, 1964

Approved:

Harold J. Humm

Harold J. Humm, Supervisor

Jane Philpott

Donald E. Stone

T. W. Johnson, Jr.

I. E. Gray

An abstract of a dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department of Botany in the Graduate School of Arts and Sciences of Duke University

1965

F. E.
Ph. D.
A995A
1965

ACROCHAETIUM AND KYLINIA IN THE SOUTHWESTERN NORTH ATLANTIC OCEAN

by

Khwaja Muhammed Sultanul Aziz

A study has been made of the genera Acrochaetium Nägeli and Kylinia Rosenvinge (Rhodophyta, Achrochaetiales, Achrochaetiaceae) along the southeastern coast of the United States, the Gulf of Mexico, and the West Indies.

Eight new species of Acrochaetium Nägeli and one of Kylinia Rosenvinge are described. They are A. acanthophorae, A. alacranense, A. chondriae, A. galaxaurae, A. hummii, A. islamii, A. reniforme, A. stypopodiae and Kylinia blomquistii. Twenty-three more species of Acrochaetium were examined from various localities and major herbaria in the eastern United States. The variations in the specimens examined were noted and in most cases the known geographical distribution of the species was extended.

Sexual reproduction in A. dasyae, A. daviesii, and A. liagorae is reported for the first time. It is proposed that A. intermedium Jao be merged with A. dasyae Collins. The writer came to the conclusion that A. trifilum (Buffham) Batters, A. parvulum (Kylin) Hoyt, A. moniliforme (Rosenvinge)

Børgesen, A. maluinum Hamel, A. crassipes (Børgesen) Børgesen, A. compactum Jao and Chantransia hallandica Kylin var. parvula (Kylin) Rosenvinge are one and the same species. A. trifilum (Buffham) Batters is considered to be the valid name.

A list of species of Acrochaetium from all the oceans was made with references, synonyms, distribution and hosts. A. balticum (Rosenvinge) Nov. Comb., A. hirsutum (Drew) Nov. Comb., A. sessile (Nakamura) Nov. Comb. and A. deliseae Nom. Nov. was established.

It is proposed that the genus Acrochaetium be divided into two sections depending on whether the plants grow completely inside the host (sometimes excluding the sporangia) or whether parts or the entire plant grow on the surface of the host. The latter section was divided into two sub-sections based on unicellular or multicellular nature of the holdfast.

ACKNOWLEDGMENTS

The writer is indebted to Dr. Harold J. Humm for his constant guidance throughout the work and assistance in the preparation of the manuscript. Dr. Humm has made it possible for the writer to take numerous field trips including the Expedition to Alacran Reef, Campeche Banks, Southern Gulf of Mexico. He has also kindly turned over to the writer many of his personal collections.

The writer is also indebted to Dr. I.E. Gray, Department of Zoology, Duke University, Dr. T.W. Johnson, Dr. Jane Philpott, Dr. D.E. Stone, and Dr. R.L. Wilbur, Department of Botany, Duke University for their criticism and valuable suggestions.

Thanks are due to Dr. Mason Hale, Smithsonian Institution, United States National Museum, Washington, D.C., Dr. I.M. Lamb, Farlow Herbarium, Cambridge, Massachusetts and Dr. D.J. Rogers, New York Botanical Garden, New York, N.Y., for making available the facilities in the respective herbaria.

The writer is grateful to Miss D.V. Shaio, Bogota, Colombia, South America, for helping with the illustrations and for providing constant help in translating many French and Spanish publications. Thanks are due to Miss Elke Fricke, Reckinghausen, Germany, for translation of many German publications.

Thanks are due to Dr. F.A. Wolf, Emeritus Professor of Botany, Duke University, for translation to Latin of all the new species described.

Grateful acknowledgment is made to the United States Educational Foundation in Pakistan for awarding the writer a Fulbright scholarship for the year 1959-1960.

The author is thankful to many more people for their help and their collections.

K.M.S.A.

CONTENTS

ACKNOWLEDGMENTS..... v

LIST OF ILLUSTRATIONS..... ix

INTRODUCTION..... 2

REVIEW OF THE LITERATURE..... 6

ACROCHAETIUM Nägeli..... 24

Key to the species of Acrochaetium and Kylinia..... 26
A. pulchellum Børgesen..... 32
A. sargassi Børgesen..... 33
A. trifilum (Buffham) Batters Sp. Emend..... 34
A. dufourii Collins..... 40
A. unipes Børgesen..... 41
A. opetigenum Børgesen..... 42
A. affine Howe & Hoyt..... 43
A. hoytii Collins..... 44
A. netrocarpum Børgesen..... 46
A. ernothrix Børgesen..... 47
A. islamii Sp. Nov..... 48
A. gracile Børgesen..... 50
A. caespitiforme Børgesen..... 51
A. globosum Børgesen..... 52
A. leptonema (Rosenvinge) Børgesen..... 52
A. stypopodiae Sp. Nov..... 53
A. galaxaurae Sp. Nov..... 55
A. sancti-thomae Børgesen..... 57
A. bisporum (Børgesen) Børgesen..... 59
A. hummii Sp. Nov..... 59
A. seriatum Børgesen..... 63
A. flexuosum Vickers..... 65
A. sagraeanum (Montagne) Bornet..... 66
A. robustum Børgesen..... 68
A. antillarum Taylor..... 69
A. daviesii (Dillwyn) Nägeli..... 70
A. reniforme Sp. Nov..... 71
A. comptum Børgesen..... 73
A. bornetii Papenfuss..... 74
A. alacranense Sp. Nov..... 75
A. dasyae Collins..... 76
A. radians Hamel..... 79

A. occidentale Børgesen..... 80
A. chondriae Sp. Nov..... 80
A. phacelorhizum Børgesen..... 82
A. avrainvillae Børgesen..... 83
A. hormorhizum Børgesen..... 84
A. repens Børgesen..... 84
A. hypneae (Børgesen) Børgesen..... 85
A. nemalionis (De Notaris) Bornet..... 86
A. infestans Howe & Hoyt..... 87
A. alcyonidiae Jao..... 89
A. virgatulum (Harvey) J. Agardh..... 90
A. thuretii Collins & Hervey..... 93
A. liagorae Børgesen..... 94
A. acanthophorae Sp. Nov..... 96

KYLINIA Rosenvinge..... 98

K. blomquistii Sp. Nov..... 99

ACROCHAETIUM SPECIES LIST (WORLD FLORA)..... 103

DISCUSSION..... 166

Nature of Genera..... 166
Fundamental Generic Characters..... 167
Evolutionary Speculations..... 170
Sexual Reproduction and Life Histories..... 174
Substrata..... 176
Nutrition..... 178
Intertidal Zone..... 179
Light..... 180
Temperature..... 181
Distribution..... 181
Proposed Classification..... 182

SUMMARY..... 185

LITERATURE CITED..... 187

BIOGRAPHY..... 234

LIST OF ILLUSTRATIONS

1. Acrochaetium acanthophorae, Pl. III, Figs. 12-13.

2. Acrochaetium alacranense, Pl. III, Fig. 11; Pl. XV, Fig. 1.

3. Acrochaetium alcyonidiae, Pl. XIII, Fig. 4.

4. Acrochaetium chondriae, Pl. IV, Figs. 1-2; Pl. V, Figs. 2-4.

5. Acrochaetium dasyae, Pl. I, Pl. VI, Figs. 1-2; Pl. VII, Figs. 1-5.

6. Acrochaetium ernothrix, Pl. XV, Fig. 3.

7. Acrochaetium galaxaurae, Pl. III, Figs.5-10.

8. Acrochaetium gracile, Pl. X, Fig. 3.

9. Acrochaetium hummii, Pl. VIII, Figs. 1-6; Pl. IX, Figs. 1-4; Pl. X, Fig. 4.

10. Acrochaetium hypneae, Pl. II, Fig. 18; Pl. X, Figs. 1-2.

11. Acrochaetium infestans, Pl. II, Fig. 17.

12. Acrochaetium islamii, Pl. III, Figs. 3-4.

13. Acrochaetium liagorae, Pl. II, Figs. 19-21; Pl. XV, Fig. 2.

14. Acrochaetium reniforme, Pl. III, Figs. 1-2.

15. Acrochaetium sagraeanum, Pl. XII, Figs. 1-2.

16. Acrochaetium sargassi, Pl. V, Fig. 1.

17. Acrochaetium seriatum, Pl. XIII, Figs. 1-2.

18. Acrochaetium stypopodiae, Pl. III, Figs. 14-15.

19. Acrochaetium trifilum, Pl. II, Figs. 1-16; Pl. XI, Figs. 1-7.

20. Acrochaetium virgatulum, Pl. XII, Fig. 3; Pl. XV, Fig. 4.

21. Kylinia blomquistii, Pl. VI, Figs. 3-6; Pl. XIV, Figs. 1-4.

22. Map showing the known geographical distribution of Acrochaetium, Pl. XVI

ACROCHAETIUM AND KYLINIA IN THE SOUTHWESTERN NORTH ATLANTIC OCEAN

INTRODUCTION

Acrochaetium Nägeli is a genus of very small, mostly epiphytic marine red algae of the Subclass Florideae, Order Nemalionales, Family Acrochaetiaceae. The Florideae are characterized by protoplasmic connections between cells and the plants usually occur as both diploid and haploid vegetative phases. The Nemalionales is the most primitive order of the subclass; the plants are filamentous, uninucleate and this order is the only one of the Florideae in which the tetrasporic phase is lacking. Reduction division occurs in the production of carpospores from the zygote. Asexual reproduction is usually by monospores. In the Acrochaetiaceae, the plants are very small, uniseriate, with apical growth, the cells having one or more chromatophores. Where only one chromatophore is present, it may be parietal or axial in position. Sexual reproduction involves spermatia and a carpogonial branch of one to three cells. After fertilization, a small cystocarp is produced in which carposporangia are borne on sparingly-branched gonimoblast filaments. Asexual reproduction is typically by monosporangia borne laterally or terminally,

but in some bi-, tetra-, or poly-sporangia are produced.

This paper is concerned with two rather widely accepted genera at the present time, Kylinia Rosenvinge and Acrochaetium Nägeli. In Kylinia the chromatophores are axial and stellate; in Acrochaetium they are parietal and of simple or lobed plates. Plants of both these genera are usually less than one millimeter tall when mature and are virtually invisible without magnification except where they grow in dense stands. For this reason and also because of taxonomic difficulties they present, these plants have been generally overlooked or ignored by phycologists. Consequently, much confusion and controversy has arisen concerning them.

During the summer of 1960, when the writer was a member of the class in marine algae at the Duke University Marine Laboratory, Beaufort, North Carolina, he developed an interest in the Acrochaetium-Kylinia group when it became apparent that there were a number of species in the Beaufort area that had not been recorded and because of the many obvious problems these plants presented in their taxonomy and distribution. It was apparent that these plants needed some careful study before their distribution along the Atlantic coast of North America could be determined. Accordingly, a dissertation subject of the taxonomy and distribution of Acrochaetium and Kylinia along the southeastern coast of the United States, the Gulf of Mexico

and the Caribbean was chosen because of the potential contribution that such a study could make. While this study involved the gathering together of the literature of all the known species of these two genera of the entire world, it was felt that it would be unwise to attempt to go beyond the region indicated in this initial study because of the difficulties forseen not only in generic and species concepts and characters, but also because of the difficulty in obtaining type material and other collections for study.

This study of the genera Acrochaetium and Kylinia is based on extensive collections from the southwestern North Atlantic, and the Pacific coasts of Washington and Oregon. In addition, all the herbarium specimens of Acrochaetium and related genera available in the herbaria of the United States National Museum (US), New York Botanical Garden (NY), and Farlow Herbarium (FH) have been critically studied. Besides the Duke University Herbarium (DUKE) and the herbaria mentioned above, other herbaria where the author has worked are: Virginia Institute of Marine Science, Gloucester Point, Virginia; Duke University Marine Laboratory, Beaufort, North Carolina; Bears Bluff Marine Laboratory, Charleston, South Carolina; University of Miami Marine Laboratory, Miami, Florida; Gulf Coast Research Laboratory, Ocean Springs, Mississippi; Oregon Institute of Marine Biology, Charleston, Oregon; and Friday Harbor Marine Laboratory, Friday Harbor, Washington.

While many problems remain to be solved in the Acrochaetium-Kylinia group, it is hoped that this dissertation will provide a better understanding of the species and their distribution in southeastern North America and a clearer concept of these genera.

REVIEW OF THE LITERATURE

The first Acrochaetium-like plant was described by Roth (1800, p. 192) under the name Conferva hermanni. The description was short, "C. filamentis aequalibus, caespitosis, tenuissimis, brevissimis, ramosissimis." This freshwater species was destined to be a much-discussed one by later authors and to be shifted around in many genera, as will be discussed later.

De Candolle (in Lamarck et De Candolle 1805, p. 49) described Chantransia as a new genus and referred to Prolifera et Polysperma Vauch. and Confervae spec. Linn. as synonyms. He listed the following species of Chantransia:

"1. Chantransie en collier C. torulosa

2. Chantransie fluviatile C. fluviatilis

3. Chantransie bifurquée C. bichotoma

4. Chantransie noire C. arta

5. Chantransie pelotonée C. glomerata

6. Chantransie des ruisseaux C. rivularis

7. Chantransie crepue C. crispa

8. Chantransie à vessie C. vesicata"

It was shown by the later workers that these species actually belong to the genera Lemanea, Cladophora and Oedogonium. Chantransia torulosa has been transferred to Lemanea torulosa (Roth) Agardh (L. incurvata Bory). Chantransia fluviatilis has been transferred to Lemanea fluviatilis (L) Agardh (Lemanea corallina Bory) which is the type of the genus Lemanea Bory. Chantransia bichotoma Bory is now known as Lemanea rigida Sirodot. Chantransia arta D.C. has been transferred to Batrachospermum dillenii Bory (Lemanea batrachosperma var. setacea Bory). Chantransia glomerata D.C. is actually a species of Cladophora, C. glomerata (L) Kütz. Chantransia rivularis D.C. has been transferred to Cladophora insignis (Ag.) Kütz. var. genuina (Kütz.) Raben. f. rivularis (Vaucher) Rabenhorst. The last two species of the list belong to the genus Oedogonium. Chantransia vesicata (Vaucher) De Candolle is Oedogonium vesicatum (Lyngbye) Wittrock. Chantransia crispa (Vaucher) De Candolle is probably Oedogonium capillare var. natans Kütz.

Drew (1928) discussed in detail this aspect of Chantransia De Candolle. All the species included in the genus Chantransia by De Candolle have been permanently transferred to other genera.

Roth (1800, pp. 281-287) described Conferva chalybea as a new species which Dillwyn (1809) recorded as C. chalybea

(p. 61) (Conferva corymbifera, p. 62). In the same publication Dillwyn described Conferva daviesii (p. 73, Sup. pl. F) as: "Filis ramosis, erectis minutis, liberis roseis, ra-mis sparsis acuminatis; articulis diametro triplo longiaribus." This description was based on dried specimens. Acrochaetium daviesii was proposed later, based on this. He also described C. minutissima (p. 71, Sup. pl.F).

Desvaux (1809) included the freshwater species of this group in the genus Chantransia. He transferred Conferva hermanni Roth to Chantransia although he was not sure whether he should have done so as he stated (1809, p. 310), "Je ne rapporte cette plante au genre Chantransia qu'avec incertitude."

Bory (1823) established the genus Auduinella. Three species were included by him, A. funiformis (Lyngbye), A. chalybea (Roth) and A. miniata (Roth). The last one was the same as Conferva hermanni Roth and Chantransia hermanni (Roth) Desvaux.

Lyngbye (1819) established the genus Ectocarpus and included Conferva chalybea as Ectocarpus chalybea.

Conferva hermanni was listed as Ceramium pulchellum by C. Agardh (1812). In 1817 the same author reported Conferva chalybea as Ceramium pulchellum var. chalybeum. Agardh (1824) included the species of this group in the genus Trentepohlia as follows (p. 37):

"Tr. pulchella, filis virgatis caespitosis purpureis, ramis strictis, articulis diametro triplo longioribus, capsulis racemosis.

Conferva hermanni Roth

Conferva nana E.B. t. 2585: nullo modo Dillw. t. 30 and vix Lyngb. t. 52.

Chantransia hermanni Desvaux

Chantransia nana Moug. & N.N.: 0594 Ad Lemaneam & Fontinelem in fluviis Europae.

Conferva chalybea Roth Cat. 3, t. 8, f. 2 Dillw. t. 91.

Conferva corymbifera, E.B. t. 1666, f. 1

Ectocarpus chalybeus, Fl. D. t. 1666, f. 1 Lyngb. t. 44. Cum priore.

Varietates constantissimae ejusdem specieci mixtae crescentes."

The quotation above shows that the nomenclatural confusion started very early in the plants of this group.

Fries (1825) revived the name Chantransia and included two species namely C. hermanni and C. chalybea neither of which is related to any species of Chantransia De Candolle.

Harvey (1836) grouped Trentepohlia Ag. in two categories, marine and freshwater. He included T. rothii, T. floridulum, T. purpurea, T. sparsa, T. daviesii, T. secundata, and T. lenuginosa in the marine group and T. pulchella as the only freshwater species. In 1849 the same author included all the marine species in the genus Callithamnion.

The genus Acrochaetium was established by Nägeli (1861). He recognized the genus Chantransia as a freshwater relative of Acrochaetium, the latter being marine. The following species of Acrochaetium were listed by him:

1. A. daviesii (Dill.)
2. A. lanuginosum (Dill.)
3. A. pubes (Ag.)
4. A. griffithsianum
5. A. caespitosum (J. Ag.)
6. A. roseolum (Crouan)
7. A. mirabile (Suhr)
8. A. secundatum (Lyngb.)
9. A. lenormandi (Suhr)
10. A. spinulosum (Suhr)
11. A. savianum (Menegh.)
12. A. ? pallens (Zanard.)
13. A. ? posidoniae (Zanard.)
14. A. byssaceum (Kg.)
15. A. efflorescens (J. Ag.)
16. A. luxurians (J. Ag.)
17. A. ? sparsum (Harv.)
18. A. minutissimum (Suhr)
19. A. ? pygmeaum (Kg.)
20. A. pulvereum
21. A. microscopicum (Nägeli)

Among these the author described in detail only A. griffithsianum, A. pulvereum and A. microscopicum.

Nägeli described Acrochaetium as a branched multicellular filamentous species, with branches usually terminating in tapering hair-shaped apical cells. He also pointed out that at the end of the filaments a spore mother cell sometimes replaced the hair. Spore mother cells were thus borne terminally, placed on short branches, or laterally on the main branches. These cells, according to him, produced many little swarm cells. The spores thus produced developed into a multicellular disc on the substratum and then gave rise to the erect filaments perpendicular to the disc. The author described the developmental stages of the disc in detail and also noted that the subsequent development of this disc, after the erect filaments were produced, was peripheral. He also reported filamentous and unicellular basal parts.

He noted the constituents of the cell to be red protoplasm which was placed freely somewhat above the cell lumen. The red protoplasm also can be arranged in ray-like filaments around the nucleus or, in other words, the chromatophore was parietal or stellate. Nägeli stated (1861, p. 404):

> "Der Zelleninhalt ist rotes Protoplasma, welches gröstenteils einem weislichen, etwas über der Mitte des Zellenlumens befindlichen, freiliegenden Kern anliegt, auch in strahlenförmige Fäden um denselben angeordnet ist, und zuweilen die Zellhüllen in ihrer obere Hälfte oder überall erfüllt."

Papenfuss (1945, p. 302) wrote "When Nägeli (1861) established Acrochaetium he made no mention of the Chromatophore." Evidently Papenfuss overlooked the part quoted above. Furthermore, the species reported by Nägeli has representatives with both types of chromatophore. However, Papenfuss (1945) interpreted this to support his idea that Nägeli "made no mention of the chromatophore," as he stated "Moreover the species which he assigned to it (Acrochaetium) show one or the other of all three types." The third type referred to here is the spiral chromatophore.

Earlier in the same publication Nägeli established the genus Rhodochorton (p. 121) which reproduce by tetraspores, thus differing from Acrochaetium in this respect.

Thuret (in Le Jolis, 1863) revitalized Chantransia Fries by including the marine monospore-bearing species of Callithamnion. However, his description of Chantransia corymbifera was evidently composed of two different species. One was an epiphyte on Ceramium rubrum and the other a hemiendophyte in Helminthocladia purpurea. Thuret (1876) gave the detailed description of the species growing on the latter host which was later transferred to Acrochaetium corymbiferum (Thuret) Batters and finally to A. bornetii Papenfuss.

Farlow (1881, p. 109) reported Trentepohlia virgatula and T. daviesii from New England, classifying them as "Florideae incertae sedis" (p. 108).

Sirodot (1884) showed that Chantransia chalybea (Roth Fries is only the representative of a juvenile stage of some species of Batrachospermum, a freshwater red alga. Whether Chantransia hermanni (Roth) Desvaux is also a stage of a species of Batrachospermum has not been established but it is strongly suspected to be so. Brand (1897) made a detailed survey of literature on a number of species of Chantransia which are an alternate generation of Lemanea, Batrachospermum or Thurea. His paper was primarily concerned with the fresh-water forms of Chantransia. He also recognized and described several independent species of Chantransia.

Schmitz (1889) transferred all the species described by Nägeli(1861) under the genus Acrochaetium to Chantransia designating C. corymbifera, as the type of this genus. This presented still another concept of the genus Chantransia.

Batters (1896a) created a new genus Colaconema, describing three new species. All of these were transferred to the genus Acrochaetium by later workers. The transfer to A. chylocladiae was made by Batters himself in 1902.

Bornet (1904) in the first part of his publication gave a detailed account of Chantransia corymbifera Thuret, which he

resolved to be composed of two different species. He concluded that the species growing on Ceramium was Chantransia efflorescens Kjellman var. thuretii, and for the species growing on Helminthocladia he proposed to conserve the name Chantransia corymbifera. The former was established as a monoecious epiphytic species and the latter as a dioecious endophytic one. He proposed that the name Chantransia be retained for the species with sexual reproduction and the name Acrochaetium be used for the species without any sexual reproduction. Later in the same paper Bornet emphasized the importance of the mode of attachment of the species of Acrochaetium and Chantransia. He divided these two genera into six sections based on the mode of attachment as follows:

"I. Thalle inférieur formé par une seule cellule epiphyte unipolaire, c'est-a-dire emettant des pousses dressées ou horizontales, mais pas de pousses descendantes.

II. Spore germée persistant sous forme d'une grosse cellule globuleuse bipolaire, c'est-a-dire emettant des pousses dressées libres et des pousses descandantes endophytes.

III. Spore germée ne se distinguant ni par sa forme, ni par sa grosseur de cellules qu'elle a produites. Thalle inférieur formé de filaments entrelacés qui s'enfoncent dans le tissu de la plante hospitalière.

IV. Spore germée ne se distinguant ni par sa forme, ni par sa grosseur des cellules qu'elle a produites. Thalle inférieur horizontal formé de filaments entrelacés, epiphytes, a croissance indéterminée.

V. Spore germée indistincte. Thalle inférieur horizontal epiphyte composé de filaments rampants, rayonnants, stoloniformes, libres.

VI. Spore germée indistincte. Thalle inférieur horizontal en forme de disque."

He examined many specimens of various exsiccates and thus was able to put various species of both Chantransia and Acrochaetium in the appropriate section excepting that he did not find any Acrochaetium species that belonged to section II or any Chantransia species that belonged to sections IV and V. This publication is notable for the transfer to Acrochaetium of many species previously placed in several other genera. Even though the basis on which he based his transfers is no longer valid, he is the authority of many species of Acrochaetium.

Kylin in his early publications (1906, pp. 113-126; 1907, pp. 114-122; 1928, pp. 5-8) recognized the genus Chantransia but he (1906, p. 122) was of the opinion that a new genus was needed for the species with spiral chromatophore. However, he did not establish this new genus until later (see below p. 20).

Rosenvinge (1909, pp. 80-144) published a well-described and illustrated account of Danish species of this group. He recognized the genus Chantransia (De Candolle) with two subgenera Euchantransia and Grania. The latter subgenus contained

species with spiral chromatophores (see Kylin 1906 above). His concept of the genus was based on Schmitz (1889). Rosenvinge reported 24 species of Chantransia of which fifteen were new species. He divided the genus into four groups, as follows:

> "Group I. Frond epiphytic with a single basal cell." (p. 88)
>
> "Group II. Frond epiphytic with a pluricellular basal layer." (p. 100)
>
> "Group III. Frond partly or entirely endophytic." (p. 121)
>
> "Group IV. Frond epiphytic or partly endozoic; chromatophores long, usually spiral shaped, more than one; carpogonia often intercalery, carpospores seriate." (p. 134)

He also erected a new genus Kylinia with K. rosulata as the type. On p. 144 he stated:

> "In spite of the likeness of our plant to the genus Chantransia in habit and in the monosporangia, it seems correct not to refer it to this genus but to regard it as the representative of a new genus, characterised in particular by the androphore cell being very different from the ordinary cells, and further by the development and structure of the cystocarps."

Thus it is clear that Rosenvinge erected this genus on the basis of the androphore cell and the development and structure of the cystocarps.

Brand (1910) included both freshwater and marine species in the genus Chantransia which he divided into two sections

(p. 116) on the basis of their being marine or freshwater.

De Toni (1897, 1903-05 and 1924) in his compilation listed 141 species (including the doubtful ones) under the genus Chantransia which included some taxa not related to each other. In 1897 (pp. 66-75) he listed 37 species including Trentepohlia aeruginosa. In 1903-05 (pp. 1865-1867) he added ten more species to the list and finally in 1924 (pp. 33-73) he added 94 species. On p. 73 he included Acrochaetium minutissimum (Suhr) Nägeli as "species excludendae aut valde dubiae," under the subgenus Audouinella Bory.

Børgesen in his earlier publications (1902 and 1909) used thename Chantransia but later (1915, 1920, 1923, 1924, 1927, 1933, 1937, and 1942) he recognized Acrochaetium Nägeli. He made valuable contributions to this genus. But for him very little of this genus would have been known from the Caribbean area (1915 and 1920). His illustrations are good and descriptions are detailed. Børgesen (1915) was the first to demonstrate that there are cases where the demarcation between the epiphytic and the endophytic species is not clear.

Hamel (1925) separated Acrochaetium from Rhodochorton by the absence or the presence of tetraspores respectively, as did Nägeli in 1861.

An extensive study in this group was made by Hamel (1927). He starts his monograph by stating:

"Les Algues marines ou d'eau douce appartenant à ce que l'on appelle actuellement des Chantransia doivent être rattachées à trois genres differents, dont un pour les plantes marines et deux pour les Algues d'eau douce."

Accordingly he later transferred all the marine species to the genus Acrochaetium Nägeli. He divided the genus into three groups (p. 79) as follows:

"J'ai divisé le genre en trois groupes suivant l'example de Rosenvinge:

1. Espèces fixées par une cellulle basale unique (= Section I de Bornet).

2. Espèces endophytes (= Sections II et III de Bornet)

3. Base multicellulaire (= Sections IV, V, VI de Bornet)."

On p. 102 he has a fourth artificial group of species whose mode of attachment is unknown. In the same publication while dealing with Acrochaetium of the coast of France he treated the second group as "Espèces à base endophyte," (p. 26). Thus it may be assumed that what he meant by "Espèces endophytes" above, is an endophytic base. He also recognized subgenus Grania Rosenvinge (p. 102-103). Hamel's work is an excellent one and has contributed to the better understanding of the genus Acrochaetium.

It seems worthwhile to point out that Hamel's "Recherches sur les genres Acrochaetium Naeg. et Rhodochorton

Naeg." was first published by R. Jacqueline in 1927. The same work was published in Review Algologique in 1928. Later the same work was part of a book entitled "Floridées de France," which was a compilation of his work on the red algae of France. Most subsequent workers have made reference to his 1928 publication.

While Hamel was working with the species of the coasts of France, Drew was working with the species of the Pacific coast of North America. Drew (1928) made a detailed study on the nomenclatural confusion. She stated (p. 150):

> "Yet, as we have seen, the use of either character, type of sporangium or cell structure proves unsatisfactory and is productive of confusion. It is therefore proposed that all the species be grouped together in one genus."

Accordingly she transferred the species of Acrochaetium to Rhodochorton (pp. 151-152). With the emended concept of the genus she discussed various aspects of the genus. She reported 35 species from the Pacific coast of North America, 18 of which were newly described. This work is of great help to those concerned with the species of the Pacific coast of North America. She pointed out that some intracellular species are possibly parasitic. With regard to Rhodochorton obscurum Drew she notes (p. 194):

> "It is very evident that the protoplast of the host cell recedes and disappears with the growth of the invading filament."

Jao (1936) described seven new species from Woods Hole, Massachusetts. Taylor (1937) reported 21 species of Acrochaetium from the Northeastern coast of North America, including the species reported by Jao.

Kylin (1944) redefined Kylinia Rosenvinge. According to him, Rosenvinge's observation of the hyaline stalk cells that bear spermatia are only the beginning of hairs (Kylin 1944, p. 12):

> "Meiner Meinung nach stellen indessen die von Rosenvinge beschriebenen und abgebildeten Tragzellen junge Haarbildungen dar."

However, based on the type species K. rosulata Rosenvinge, Kylin decided that the unicellular holdfast was the character that separated Kylinia from Acrochaetium. The latter genus would thus be characterized by multicellular holdfast. In the same publication on p. 13 in the footnote he transferred 19 species of Acrochaetium to Kylinia.

Kylin following his own suggestion of 1906, as mentioned above, established a new genus Grania (pp. 26-27) based on the spiral chromatophore of the cells.

Papenfuss (1945) merged Kylinia Rosenvinge with Acrochaetium Nägeli. He stated (p. 304):

> "The feature whereby Kylinia is separated from Acrochaetium is so insignificant, however, that it seems best to unite it with the latter."

Acrochaetium, according to him, contained one parietal or

laminate chromatphore in each cell. Earlier in this paper he erected Chromastrum gen. nov. (p. 300) for those species "whose cells contain one or more stellate chromatophores." He made 34 new combinations with the genus Chromastrum (pp. 320-325). He also listed 136 species of Acrochaetium (pp. 305-319) and divided them into the following three groups (p. 305):

"Group I. Frond epiphytic or epizoic, with a single basal cell.

Group II. Frond epiphytic or epizoic, with a multicellular basal layer.

Group III. Frond partly to almost wholly endophytic or endozoic."

The genus Chromastrum was later replaced by the genus Kylinia by Papenfuss (1947) after the publication of Kylin (1944) became available to him. However, he accepted neither Rosenvinge's nor Kylin's concepts of the genus, but he retained the generic concept of Chromastrum for Kylinia. Papenfuss (1945 and 1947) did an excellent job in making a list of species of Acrochaetium, Kylinia and related genera, which brought the species list of Hamel (1927) up to date.

Levring (1953) described Kylinia australis from southern Australia. This species corresponded to the conception of the genus Kylinia Rosenvinge. K. australis is dioecious in contrast to K. rosulata Rosenvinge which is monoecious. Levring had correspondence with Feldmann and had access to

information which was published by the latter author in 1958. Levring (1935a, 1935b, 1937, 1940, 1941, 1942, 1945, 1953 and 1955) made appreciable contributions to the genus Acrochaetium by describing new species and extending geographical distribution of many species.

Feldmann (1958) gave detailed description of the developmental stages of the carpogonium and carpospores of Kylinia rosulata and reaffirmed the observation of Rosenvinge regarding a hairlike androphore, for which he suggested the term spermatocystophore (pp. 496-497). He pointed out that Kylin was wrong in stating that Rosenvinge's observation of the special androphore was a mistake. This was a result of Feldmann's discovery of similar plants near Roscoff, France, some with cells of the type described by Rosenvinge, others with cells of the type described by Kylin. This discovery allowed him to come to the conclusion that Kylin had wrongly identified some plants as K. rosulata, which presented very different characteristics. Feldmann described the species as Acrochaetium kylinoides. It may be interesting to note here that Feldmann confirmed the observation of Rosenvinge that K. rosulata had parietal chromatophores whereas Acrochaetium kylinoides had stellate chromatophores.

Feldmann asserted that since Kylinia Rosenvinge was being maintained as a type species, epiphytic on Sporochnus

pedunculatus, it could not be transferred to a group of species which was placed in the genus Acrochaetium, no matter what character was used to separate them. On p. 499 he stated:

> "Le genre Kylinia étant maintenu pour l'espèce-type, epiphyte sur le Sporochnus pedunculatus, telle que l'a decrite Rosenvinge, ne peut être appliqué à un groupe espèces jusqu' ici placées dans le genre Acrochaetium quel que soit le caractère invoqué pour les en séparer."

Feldmann (1962) proposed to create a separate order for the plants of this group, namely, Acrochaetiales (p. 219). He stated that the lack of a carpogonial branch and the extreme simplicity of the vegetative frond were sufficient reasons to put these algae in a separate order.

ACROCHAETIUM Nägeli

Family Acrochaetiaceae

Order Acrochaetiales

Class Florideae

Phyllum Rhodophyta

Plants 0.025 mm. to 6 mm. tall, usually 0.1 to 2 mm., epiphytic, endophytic, epi-endophytic, endozoic, epi-endozoic, or lithophytic; erect part composed of branched uniseriate filaments, rarely unbranched; unicellular or multicellular; when multicellular, composed of loosely branched filaments, rarely unbranched, sometimes pseudoparenchymatous.

Cells uninucleate with a parietal or stellate chromatophore, with or without a pyrenoid; sometimes cells of the erect part have a single laminate parietal chromatophore, while the cells of the prostrate part of the same plant have several discoid parietal chromatophores.

Asexual reproduction - by mono-, bi-, tri-, tetra- or polysporangia that are lateral or terminal, sessile or stalked; reproduction by monosporangia most common.

Sexual reproduction known only in a few species; sexual plants monoecious or dioecious; spermatangia usually borne in clusters, sometimes in pairs, rarely solitary; carpogonia solitary, lateral, sessile or stalked, or terminal; gonimoblast filaments composed of several cells which give rise to a few carposporangia.

The above description is inclusive of Kylinia (Rosenvinge) Kylin, but exclusive of Kylinia Rosenvinge. However, if any species of Acrochaetium are found to bear spermatia on special filaments known as androphores, they will have to be transferred to Kylinia Rosenvinge, a genus which so far consists of extremely minute plants, less than 85μ in height.

The following is a key and descriptions of species from the Southeastern North Atlantic Ocean. In most cases variations were noted and are included as minor emendations of the descriptions that follow. The voucher specimens submitted were either mounted on a slide or mounted on a herbarium sheet or submitted in both forms in the Duke University Herbarium.

Key to the Species of *Acrochaetium* and *Kylinia* in the Southwestern North Atlantic Ocean

1. Plants monoecious or dioecious, when dioecious male and female plants alike, spermatangia not produced on androphores.....(*Acrochaetium*)..... 2

1. Plants dioecious, male and female plants unlike, spermatangia borne on androphores (*Kylinia blomquistii*) p. 99

2. Part or the entire plant outside the host..... 3

2. Entire plant endophytic (sometimes excepting monosporangia)..... 48

3. Base consisting of the original spore (one celled) or two celled as a result of a wall in the middle of the original spore (when unicellular rarely with a few short secondary cells)..... 4

3. Base composed of multicellular filaments or a parenchymatous disc..... 11

4. Base unicellular consisting of the original spore..... 5

4. Base bicellular, original spore divided into two cells, later losing identity..... ..... *A. pulchellum* p. 32

5. Base consisting of a concave disc by which the plant attaches to the substratum..... *A. sargassi* p. 33

5. Base not composed of a concave disc..... 6

6. Plants less than 200μ in height..*A. trifilum* p. 34

6. Plants more than 200μ in height..... 7

7. Basal cell 5-9μ diam..... *A. dufourii* p. 40

7. Basal cell 12μ or more in diam..... 8

8. Basal cell with an endophytic descending process..... 9

8. Basal cell without any specialized descending process..... 10

9. Basal cell always narrowest in the middle, expand at the lower end..... A. unipes p. 41

9. Basal cell cuneate, narrowest at the tip..... ..... A. opetigenum p. 42

10. Basal cell ellipsoid to pyriform conspicuously penetrating into the host tissue, (sometimes with a few short secondary cells).. A. affine p. 43

10. Basal cell spherical, not conspicuously penetrating into the host tissue, usually epiphytic..... A. hoytii p. 44

11. Base a parenchymatous disc, sometimes with short free filaments at the margin..... 47

11. Base composed of free filaments sometimes aggregated into a pseudoparenchymatous disc..... 12

12. Plants for the most part endozoic; epizoic filaments short, erect, bearing monosporangia... 46

12. Plants neither endozoic nor epi-endozoic..... 13

13. Lower portion of the erect filaments about 5-6μ diam.... 14

13. Lower portion of the erect filaments more than 6μ diam.. 20

14. Monosporangia about twice as long as broad..... 15

14. Sporangia much shorter, usually slightly longer than broad..... 19

15. Monosporangia fusiform with a truncate summit..... ..... A. netrocarpum p. 46

15. Monosporangia not fusiform..... 16

16. Base of plant endophytic..... 17

16. Base of plant epiphytic or epi-endophytic..... 18

17. Endophytic filaments more or less horizontal to the host surface, usually extensive erect filaments with numerous short branches ending in a multicellular hair..... A. ernothrix p. 47

17. Endophytic filaments more or less perpendicular to the host surface, usually short. Hairs, if present, are borne at the tip or long branches..... A. islamii p. 48

18. Erect filaments little branched, sporangia chiefly on the main filaments, rarely on branches..... A. gracile p. 50

18. Erect filaments freely branched above, sporangia on branches..... A. caespitiforme p. 51

19. Monosporangia on short opposite branchlets, 7-8μ diam..... A. globosum p. 52

19. Monosporangia on main branches, not opposite, 5.5-6μ diam..... A. leptonema p. 52

20. Base of plants entirely external to the host or epi-endophytic..... 21

20. Base of plants entirely endophytic..... 33

21. Base of plants entirely external to the host..... 22

21. Base of plant epi-endophytic..... 29

22. Holdfast extends beyond the host surface..... ..... A. stypopodiae p. 53

22. Holdfast does not extend beyond the host surface..... 23

23. Cells of the erect filaments smaller in diameter than the cells of the creeping part..... A. galaxaurae p. 55

23. Cells of the erect filaments not smaller in diameter than the creeping part..... 24

24. Cells of the erect filaments short, mostly barrel shaped..... A. sancti-thomae p. 57

24. Cells longer..... 25

25. Bisporangia abundant..... 26

25. Bisporangia absent or rare..... 27

26. Bisporangia to 14μ long, trisporangia absent.... ..... A. bisporum p. 59

26. Bisporangia 18-20μ long, trisporangia usually present..... A. hummii p. 59

27. Monosporangia 9-13μ long, in long secund series, on branches..... A. seriatum p. 63

27. Monosporangia 14-22μ 28

28. Monosporangia 14-16μ long, not in long secund series..... A. flexuosum p. 65

28. Monosporangia 18-22μ long, sometimes in secund series..... A. sagraeanum p. 66

29. Basal structure a pseudoparenchymatous disc, with a thick walled unicellular endophytic process..... ..... A. robustum p. 68

29. Basal structure composed of free branched filaments..... 30

30. Plants less than 1 mm. tall..... 31

30. Plants more than 1 mm. tall..... 32

31. Erect filaments composed of a few cells, tips not hairlike.....A. antillarum p. 69

31. Erect filaments much longer, composed of many cells, with hairlike tips..... A. ernothrix p. 47

32. Monosporangia about 6μ diam., bisporangia present..... A. bisporum p. 59

32. Monosporangia 8-12μ diam., bisporangia absent.... ..... A. daviesii p. 70

33. Monosporangia reniform..... A. reniforme p. 71

33. Monosporangia not reniform..... 34

34. Original spore distinct and recognizable in the mature basal structure..... 35

34. Original spore not discernable in the mature basal structure..... 40

35. Original spore undivided (germination by germ tube)..... 36

35. Original spore divided into two cells before forming further filaments..... A. comptum p. 73

36. Erect filaments arising both from the original spore and from secondary endophytic filaments... 37

36. One erect filament arising from the germinating spore..... 38

37. Monosporangia oblong..... A. bornetii p. 74

37. Monosporangia pyriform..... A. alacranense p. 75

38. Original spore almost spherical, about as long as broad..... 39

38. Original spore distinctly longer than broad, broadest towards the upper part, plants known only on Dasya..... A. dasyae p. 76

39. Original spore about 10μ diam..... A. radians p. 79

39. Original spore about 16μ diam..... A. occidentale p. 80

40. Base with two kinds of filaments; a few cells parallel to the host surface and one or more filaments perpendicular to the host surface, erect filaments of two kinds..... ..... A. chondriae p. 80

40. Base not of two kinds of filaments, erect filaments of one kind..... 41

41. Base in part, of thick vertical filaments closely congested..... A. phacelorhizum p. 82

41. Base of vertical filaments not congested..... 42

42. Base on the loose filament of the host, known only on Ayrainvillea..... A. avrainvillae p. 83

42. Base embedded in the polysaccharide matrix of the host..... 43

43. Endophytic filaments not moniliform..... 44

43. Endophytic filaments moniliform..... A. hormorhizum p. 84

44. Cells of the endophytic filaments conspicuously irregular in size and shape..... A. repens p. 84

44. Cells of the endophytic filaments not conspicuously irregular in size and shape..... 45

45. Endophytic filaments short, monosporangia 10-12μ diam... ..... A. hypneae p. 85

45. Endophytic filaments extensive, monosporangia about 18μ long..... A. nemalionis p. 86

46. Cells of the endozoic filaments generally larger in diameter than the cells of the epizoic erect filaments, plants growing in hydroids..... A. infestans p. 87

46. Cells of the endozoic filaments generally smaller in diameter than the cells of the epizoic erect filaments, plants growing in Alcyonidium (Bryozoan)..... A. alcyonidiae p. 89

47. Chromatophore stellate, axial..... A. virgatulum p. 90

47. Chromatophore parietal..... A. thuretii p. 93

48. Monosporangia 14μ diam., 20μ long, (endophytic in Liagora).....A. liagorae p. 94

48. Monosporangia spherical, 10-11μ diam. (endophytic in Acanthophora).A. acanthophorae p. 96

ACROCHAETIUM PULCHELLUM Børgesen

Acrochaetium pulchellum Børgesen, Dansk Bot. Ark. 3: 23. 1915.

Chantransia pulchella (Børgesen) De Toni, Syll. Alg. 40. 1924.

Chromastrum pulchellum (Børgesen) Papenfuss, Univ. Calif. Pub. Bot. 18:323. 1945.

Kylinia pulchella (Børgesen) Papenfuss, Univ. Calif. Pub. Bot. 18:437. 1947.

Plants epiphytic, original spore divide into two cells, distinct in young plants, later losing identity; most of the plant creeping, short erect filaments of 1-3 cells arise from the creeping part; cells irregularly shaped, 5-6μ diam., 7-10μ long; erect cells or filaments terminate in long hairs 100μ or more in length, 2-3μ diam., chromatophore stellate with central pyrenoid; monosporangia 5-7μ diam., 9-10μ long, ovate, sessile on the prostrate part or terminal on the erect cells or filaments.

Known only from Virgin Islands on Chaetomorpha antennina.

ACROCHAETIUM SARGASSI Børgesen

Pl. V, Fig. 1

Acrochaetium sargassi Børgesen, Dansk Bot. Ark. 3:17. 1915.
Chantransia sargassi (Børgesen) De Toni, Syll. Alg. 1924.

Plants with a holdfast comprised of a disc of about 20μ diam., made of cell wall material, produced by and at the base of the original spore; a single filament arises from the base which starts branching one or two cells above the unicellular base; main filament 5.5μ diam., in vigorous plants 8μ diam.; plants 600-700μ tall; monosporangia about 7μ diam., 10μ long, oval-obovate; sexual plants dioecious.

Previously known from Virgin Islands, Florida, and East Indies, on Sargassum, Padina, Pocockiella, Diplanthera, Syringodium, Ruppia and Bryozoan. This report extends the distribution of this species to North Carolina and Alacran Reef, Mexico, on Sargassum filipendula and S. hystrix.

Much variation was observed in the specimens from North Carolina. In many cases Sargassum filipendula plants are almost entirely covered by A. sargassi. In densely crowded specimens of North Carolina, A. sargassi is found to grow 1.5 mm. tall, the basal disc is 13-23μ diam., 13-19μ long. Sexual plants are rare.

Specimens examined: NORTH CAROLINA all on Sargassum filipendula; drifting near the Duke Marine Laboratory pier Beaufort, Aziz, June 25, 1960 (DUKE); in shallow water, Shackleford Breakwater, Aziz, July 29, 1961 (DUKE); in shallow water, Radio Island Breakwater, near Beaufort, Aziz, August 4, 1961 (DUKE); Fort Macon, near Beaufort, Aziz, August 5, 1961 (DUKE); Shackleford Breakwater, near Beaufort, Aziz, August 12, 1962 (DUKE); Fort Macon, Aziz and Shaio, January 29, 1964 (DUKE); SOUTHERN GULF OF MEXICO on S. hystrix in shallow water, around Isla Perez, Alacran Reef, Aziz and Humm, June 29, 1961 (DUKE); VIRGIN ISLANDS on S. vulgare, St. Thomas harbor, Børgesen, December 21, 1905 (NY).

ACROCHAETIUM TRIFILUM (Buffham) Batters SP. EMEND

Pl. II, Figs. 1-16; Pl. XI, Figs. 1-7

Chantransia trifila Buffham, J. Queckett Micr. Club 2: tab. III. 1892.

Acrochaetium trifilum (Buffham) Batters, J. Bot. 40:58. 1902.

Chantransia parvula Kylin in Kjellman, Bot. stud. till:124. 1906.

Chantransia crassipes Børgesen, Bot. Tidsskr. 30:1. 1909.

Chantransia hallandica var. parvula Rosenvinge, Kgl. Dansk. Videnskab. Selskab. Skrifter. 97. 1909.

Chantransia moniliformis Rosenvinge, Kgl. Dansk. Videnskab. Selskab. Skrifter. 97. 1909.

Acrochaetium crassipes (Børgesen) Børgesen, Dansk Bot. Ark. 3: 20. 1915.

Acrochaetium moniliforme (Rosenvinge) Børgesen Dansk Bot. Ark. 3:22. 1915.

Acrochaetium parvulum Hoyt, Bull. U.S. Bur. Fisheries 36:470. 1920.

Acrochaetium maluinum Hamel, Recher. genus Acroch. Naeg. Rhodoch. Naeg. 24. 1927.

Rhodochorton moniliforme (Rosenvinge) Drew, Univ. Calif. Pub. Bot. 14:164. 1928.

Acrochaetium compactum Jao, Bull. Torrey Bot. Club 63:241. 1936.

Kylinia parvula (Hoyt) Kylin, Lunds Univ. Arsskr. Avd. 2, 40: 13. 1944.

Kylinia crassipes (Børgesen) Kylin, Lunds Univ. Arsskr. Avd. 2, 40:13. 1944.

Chromastrum compactum (Jao) Papenfuss, Univ. Calif. Pub. Bot. 18:321. 1945.

Chromastrum crassipes (Børgesen) Papenfuss, Univ. Calif. Pub. Bot. 18:321. 1945.

Chromastrum maluinum (Hamel) Papenfuss, Univ. Calif. Pub. Bot. 18:321. 1945.

Chromastrum moniliforme (Rosenvinge) Papenfuss, Univ. Calif. Pub. Bot. 18:322. 1945.

Chromastrum parvulum (Hoyt) Papenfuss, Univ. Calif. Pub. Bot. 18:322. 1945.

Kylinia compacta (Jao) Papenfuss, Univ. Calif. Pub. Bot. 18:436. 1947.

Kylinia moniliforme (Rosenvinge) Papenfuss, Univ. Calif. Pub. Bot. 18:437. 1947.

Plants 15-200μ tall, attached by a single, epiphytic, endophytic or epi-endophytic basal cell, basal cell sometimes attached to the substratum by a hemispherical lamellose or uniform polysaccharide layer 1-5μ thick, basal cell 5-15μ diam., 5-17μ long, of various shapes, as long as broad, up to twice as long as broad or broader than long; 1-6 erect filaments arise from the basal cell; erect filaments unbranched to highly branched; branching unilateral, alternate, opposite or a mixture of any or all of these types; unicellular hairs present or absent; cells of the erect filaments 3-16μ diam., one to two times as long as broad, rarely slightly broader than long; cells, in general, decrease in diameter from base to the apex; in branched plants the diameter of the filaments decrease in each subsequent order of branching; chromatophore mostly stellate, sometimes appearing parietal with a single central pyrenoid; monosporangia 6-9μ in diam., 7-16μ long, spherical or oval, usually sessile, sometimes pedicellate; sexual reproduction

uncommon, spermatia rare to abundant, borne at the tip of short dichotomous branches, which may be alternate or opposite; carpogonia usually rare, sometimes abundant, about 6μ diam. at the base, about 19μ long; trichogyne about 11μ long, 2-3μ diam.; carpospores usually oval, 8-10μ diam., 12-15μ long, borne terminally.

The above description was primarily based on observations of thousands of plants from many localities. Sometimes a particular locality or substratum showed a particular kind of variation which could be identified as one or more of the species mentioned above. The characteristics on which the species differences were previously based were the presence or absence of the basal hemispherical polysaccharide cushion, height of plants, diameter of the basal cell, mode of branching, diameter of the cells of the main filament and a few other characters. If extreme forms of plants are taken into consideration, it is possible to identify them as one of the above mentioned species. Some young plants with three short branches could be referred to A. trifilum; the same kind of plant when unbranched or with secund branches at maturity could be assigned to A. crassipes.

The author is of the opinion that A. trifilum (Buffham) Batters, A. parvulum (Kylin) Hoyt, A. moniliforme (Rosenvinge)

Børgesen, Chantransia hallandica Kylin var. parvula (Kylin) Rosenvinge, A. maluinum Hamel, A. crassipes (Børgesen) Børgesen and A. compactum Jao belong to the same species. Chantransia trifila Buffham was the oldest name which contained part of this complex. Thus the correct name of the plants corresponding to the above description should be A. trifilum (Buffham) Batters. Accordingly the names under which various workers reported different variations of this plant should be treated as synonyms of A. trifilum.

Previously known from North Carolina, Massachusetts, Texas, Florida, Bermuda, Hispaniola, Mexico, Juan Fernandez Islands (Chile), Vancouver Island (Canada), England, France, Baltic, Denmark, Norway, Canary Islands and India on a variety of algae.

This report extends the distribution of this species to Virginia, Bahamas, Jamaica, Oregon and Washington; on Eelgrass, Cladophora fuliginosa, Acanthophora spicifera and Callithamnion pikeanum.

Specimens examined: NORTH CAROLINA on Polysiphonia denudata and hydroids, Cape Lookout, Aziz, August 8, 1961 (DUKE); on Sargassum filipendula, Fort Macon, near Beaufort, Aziz, August 4, 1961 (DUKE); on Acrochaetium sagraeanum and Jania rubens, Cape Lookout, Aziz, August 15, 1962 (DUKE); on Spyridia aculeata, Fort Macon, Aziz, August 20, 1962 (DUKE); on

Sphacelaria furcigera, S. tribuloides and Bangia fuscopurpurea, Cape Lookout, Aziz and Shaio, October 14, 1962 (DUKE); on Sargassum filipendula, Bryopsis plumosa, Dasya pedicellata, Acrochaetium dasyae and A. sagraeanum, Fort Macon, Aziz and Shaio, January 29, 1964 (DUKE); on Polysiphonia harveyi, Beaufort, Hoyt, July 27, 1909 (US, as A. parvulum); VIRGINIA on Eelgrass, Haven Beach, Aziz, August 4, 1962 (DUKE); FLORIDA on Callithamnion halliae, Fort Lauderdale, Humm, April 23, 1962 (DUKE); on Chondria curvileneata, Bear cut, Miami, Scala, March 26, 1963 (DUKE); TEXAS on Centroceras clavulatum, Port Isabel, Hildebrand, March 31, 1954 (DUKE); SOUTHERN GULF OF MEXICO on Centroceras clavulatum and Sargassum hystrix, around Isla Perex, Alacran Reef, Aziz, June 29, 1961 (DUKE); BAHAMAS on Cladophora fuliginosa rock reef along ocean beach west of Lerner Laboratory, Bimini, Humm, April 6, 1948 (DUKE); JAMAICA on Acanthophora spicifera, Doctors Cove, Montego Bay, Humm, May 22, 1962 (DUKE); WASHINGTON on Callithamnion pikeanum, upper intertidal zone, Middle Cove, Cape Arago, Aziz, June 25, 1963 (DUKE); GOLFO DE MARSEILLE on Chaetomorpha tortuosa, Ile Ratoneau, Berner, July 11, 1929 (NY).

ACROCHAETIUM DUFOURII Collins

Acrochaetium dufourii Collins, P.B.A. no. 1594. 1909.

Chantransia dufourii (Collins) Collins, Rhodora 13:187. 1911.

Plants with a single basal cell (original spore), 5-9μ diam., spherical, bearing 1-3 erect filaments; 200-600μ tall, rarely larger; filaments sparsely branched; cells 4-5μ diam; monosporangia 5-6μ diam., 7-10μ long, sessile or stalked; sexual reproduction unknown.

Known from North Carolina and Bermuda; on Sargassum and Dictyota.

This species is rare in the collections of the writer. In the 1960 collections from North Carolina there are some A. dufourii growing on Dictyota dichotoma. The plants of the former collection have basal cells 7-9μ thick, each basal cell gives rise to 2-3 erect filaments and all filaments terminate in monosporangia.

Specimens examined: NORTH CAROLINA on Sargassum filipendula in shallow water along the sea wall, U.S. Fish and Wildlife Laboratory, Pivers Island, Beaufort, Aziz, June 25, 1960 (DUKE); on Dictyota dichotoma in shallow water, Shackleford Breakwater, near Beaufort, Aziz, July 4, 1960 (DUKE); on Dictyopteris membranacea, drifted ashore, Fort Macon, near

Beaufort, Aziz and Shaio, January 29, 1964 (DUKE); on Sargassum filipendula, Fort Macon, Hoyt, July 13, 1908 (DUKE, TYPE); BERMUDA on Dictyota ciliata, Hungry Bay, Hervey, December 1913 (US, as Chantransia dufourii).

ACROCHAETIUM UNIPES Børgesen

Acrochaetium unipes Børgesen, Dansk. Bot. Ark. 3:35. 1915.
Chantransia unipes (Børgesen) De Toni, Syll. Alg. 42. 1924.

Plants with holdfast comprised of the original spore, which penetrates the epidermal cells of the host tissue forming a process; narrowest in the middle, expanded at the lower end, 20-22μ diam., erect filaments up to 2 mm. in height, sparsely branched; cells of the main filaments 9-11μ diam., up to 5 times as long as broad. The monosporangia are 9-11μ diam., 20-22μ long, oblong-clavate, sessile, in short series. Previously known from Virgin Islands, Florida and Hispaniola on Dictyota. This report extends the distribution of this species to Alacran Reef, Mexico, on Thalassia.

The plants examined by the author were young. The basal cells of these plants are 14-15μ diam., 18-20μ long. The erect filaments are about 13μ diam., about 3 times as long as broad; these specimens also resemble A. hoytii excepting that

the diameter of the erect filaments corresponds with A. unipes. The nature of basal cell is such that it could belong to either one of the species. Børgesen did not succeed in finding A. hoytii, in Phycotheca Boreali Americana, no. 1450, to compare with his specimen. It is probable that A. hoytii and A. unipes are one and the same species.

Specimen examined: SOUTHERN GULF OF MEXICO on Thalassia, in shallow water, east side of Isla Perez, Alacran Reef, Aziz and Humm, June 26, 1961 (DUKE).

ACROCHAETIUM OPETIGENUM Børgesen

Acrochaetium opetigenum Børgesen, Dansk Bot. Ark. 38. 1915.
Chantransia opetigena (Børgesen) De Toni, Syll. Alg. 41. 1924.

Plants with distinct original spore at the base, from which an elongated cuneate prolongation grows to a length of 20μ, few short filaments may also grow in the holdfast of some plants; erect filaments one to few, arising from the holdfast, at the base filaments 8-11μ diam., in the middle of the plant 13-14μ diam., tapering again towards the summit to 6-7μ diam.; monosporangia 11μ diam., 20μ long, oblong-oval or more elongate, subcylindric or subclavate, usually sessile; sexual reproduction unknown.

Known only from Virgin Islands, on Dasya pedicellata.

ACROCHAETIUM AFFINE Howe and Hoyt

Acrochaetium affine Howe & Hoyt, Mem. New York Bot. Gard. 6:105. 1916.

Chantransia affinis (Howe & Hoyt) De Toni, Syll. Alg. 41. 1924.

Plants with a single ellipsoid to pyriform basal cell conspicuously penetrating into the host tissue, may sometimes give rise to a few cells, rarely to a few short creeping filaments, which may be epi-endophytic and more slender than the original spore; plants 1.0-3.5 mm. tall and usually highly branched; erect filaments 4-8μ diam., cells mostly 3-9 times as long as broad; asexual reproduction by monospores; sexual reproduction common; spermatia scarce, carpospores abundant, borne in lateral clusters on the main branches.

Known only from North Carolina on Spyridia, Dictyota, and other hosts.

This species is closely related to A. hoytii, A. dufourii, and A. corymbiferum. The specimens collected in 1961 had very abundant cystocarps. Hoyt (1920, p. 471) differentiated A. affine from A. corymbiferum as follows:

> "Its general habit resembles A. corymbiferum, from which it is distinguished by its larger, more persistant, partially embedded basal cell, the upright filaments often arising entirely from this; by the less abundant cystocarps, these, the antheridia and sporangia being borne on the same plants, and by the fact that the horizontal filaments, when present, are mostly external."

It is the opinion of the writer that abundance of cystocarps cannot be used as a distinguishing character between A. affine and A. corymbiferum.

During the summers of 1960 to 1963, A. affine was one of the dominant plants in Beaufort and vicinity. This plant often covered the entire surface of Dictyota dichotoma which was one of the dominant shallow water brown algae in this area during summer months.

Specimens examined: NORTH CAROLINA, on Dictyota dichotoma, Fort Macon Breakwater, near Beaufort, Hoyt, July 13, 1908 (US, TYPE); Radio Island Breakwater, near Beaufort, July 5, 1960 (DUKE); on Sargassum filipendula, in shallow water, Radio Island Breakwater, near Beaufort, Wirtensen, July 22, 1961 (DUKE); on Dictyota dichotoma in shallow water, Radio Island breakwater, near Beaufort, Aziz, August 4, 1961; (DUKE); on Dictyota dichotoma and Spyrida filamentosa, from the coral reef offshore Beaufort, Radcliffe, August 11, 1914 (DUKE).

ACROCHAETIUM HOYTII Collins

Acrochaetium hoytii Collins, Rhodora 10:134. 1908.
Chantransia hoytii (Collins) Collins, Rhodora 13:186. 1911.

Plants with a single spherical or somewhat elongate basal cell, consisting of the original spore 12-25μ diam.,

rarely producing a few short cells, basal cell slightly embedded in the tissue of the host from which 1-4 erect filaments arise; erect part 1.3 mm. tall, usually 0.5-0.65 mm.; filaments branched, about 6μ diam.; monosporangia 6μ diam., 15μ long, rounded oblong, pedicellate; cystocarps rare.

Known from North Carolina, Texas and Mexico.

This species is sometimes very hard to distinguish, especially when young, from A. affine. The differences are best stated in the words of Hoyt (1920, p. 471):

> "It [A. hoytii] is distinguished from A. affine by its smaller size, its smaller and shorter cells, its more nearly spherical and more superficial basal cell, the absence of horizontal filaments, the abundance of sporangia and great scarcity of cystocarps."

The writer found A. hoytii growing in great abundance in the Beaufort area during the summers of 1960-1963. Sometimes Dictyota dichotoma was entirely covered by the growth of A. hoytii, often intermixed with A. affine. Under the water surface, in its natural habitat, some of these Dictyota dichotoma looked like red algae with fine filaments growing out of the main axes. It was also observed that in some plants of A. hoytii, the sporangia came out from almost every cell of the erect part in secund series.

In a collection from Shackleford Banks near Beaufort, North Carolina, male plants of A. hoytii were observed but they

were scarce. This is the first report of male plants in this species.

Specimens examined: NORTH CAROLINA, all on Dictyota dichotoma, all in shallow water, Shackleford Breakwater, near Beaufort, Aziz, July 4, 1960 (DUKE); Radio Island breakwater, near Beaufort, Aziz, August 4, 1961 (DUKE); Beaufort harbor, Hoyt, October 5, 1906 (DUKE); Fort Macon Breakwater, near Beaufort, Hoyt, July 13, 1908 (US, TYPE).

ACROCHAETIUM NETROCARPUM Børgesen

Acrochaetium netrocarpum Børgesen, Dansk Bot. Ark. 3:24. 1915. Chantransia netrocarpa (Børgesen) De Toni, Syll. Alg. 55. 1924.

Plants epiphytic, basal part of short branched filaments, sometimes loosely fusing together; erect part 0.4 mm. tall, many erect filaments arising from the prostrate part; cells towards the base 5-6μ diam., at the tip 3-4μ diam.; monosporangia fusiform 4-5μ diam., 10-11μ long, always more than twice as long as broad, usually sessile; sexual reproduction unknown.

Known from Virgin Islands and Florida on Caulerpa. This report extends the distribution of this species to Southern Gulf of Mexico, on Sargassum hystrix.

Specimen examined: SOUTHERN GULF OF MEXICO, in shallow water, around Isla Perez, Alacran Reef, Aziz and Humm,

June 29, 1961 (DUKE).

ACROCHAETIUM ERNOTHRIX Børgesen

Pl. XV, Fig. 3

Acrochaetium ernothrix Børgesen, Dansk Bot. Ark. 3:59. 1915.

Erect part of the plant with two kinds of branches, one ending in a blunt tip and the other tapering to a fine point appearing as a short multicellular hair; cells of the main filament 5-6μ diam., 15-18μ long, chromatophore parietal with a pyrenoid; monosporangia ovate-oblong 5-6μ diam., 8-10μ long, sessile or pedicellate; sexual reproduction unknown.

This species has previously been reported only from Virgin Islands on Centroceras clavulatum. This report extends the distribution of this species to Gulf Coast of Florida and Alacran Reef, Southern Gulf of Mexico on Sargassum bermudense and Centroceras clavulatum.

The description of this species was based on a single specimen from the Virgin Islands. The basal structure was not observed, but Børgesen (1915, p. 60) stated: "I have arrived at the conclusion that the base most probably consists of a few creeping filaments, somewhat immersed in the tissue of the host plant."

Of the plants studied by the author, the specimens from St. Teresa, South of Tallahassee, Florida Gulf coast, agreed with Børgesen's description. The specimens from Alacran Reef were young, devoid of short,hair-like branches, but otherwise similar to A. ernothrix. In the plants from both localities, the basal parts were epi-endophytic and verified the supposition of Børgesen quoted above.

Specimens examined: FLORIDA on Sargassum bermudense, in shallow water, St. Teresa, Franklin County, Gulf coast of Florida, Humm, July 16, 1955 (DUKE); SOUTHERN GULF OF MEXICO on Centroceras clavulatum, in shallow water, near Isla Perez, Alacran Reef, Campeche Banks, Aziz and Humm, June 29, 1961 (DUKE).

ACROCHAETIUM ISLAMII SP. NOV.

Pl. III, Figs. 3-4

Named after Dr. Nurul Islam, Reader in Botany, Dacca University, Dacca, Pakistan, to whom the writer is indebted for his initial interest in algae. His contagious enthusiasm is the mark of a distinguished teacher.

Thalli epi-endophytici in Liagoram validam; pars basalis e filis repentibus in filis crescentibus hospitis; pars superficialis usque 0.2 mm. altae; cellulae filiorum endophyticorum subinde inflatae in medium usque 7 μ diam.; filis erectis

ramosis, alternis subinde in fila hyalina atque multicellula; fila erecta e cellulis 4-5μ latis diametro 1.5-3.5 longiores composita; monosporangia 4-5μ diam., 6-8μ long, solitaria vel bina, sessila vel stipitata, laterala vel terminala. Hab. Reef Bay, St. John, American Virgin Islands.

Plants growing epi-endophytically on Liagora valida, the lower portion creeping loosely in between the assimilatory filaments of the host; upper portions of the plants 0.2 mm. tall in mature plants; cells of the endophytic filaments sometimes swollen in the middle; in plants with extensive endophytic part, the original spore not discernable; cells of the endophytic filaments sometimes up to 7μ diam.; erect filaments moderately alternately branched, sometimes the tip of the branches gradually tapering to a colorless multicellular hair; cells of the erect filaments 4-5μ diam., 1.5-3.5 times as long as broad; many single erect filaments of young plants observed beyond the margin of the host, 50-150μ high; monosporangia, 4-5μ diam., 6-8μ long, sparse, solitary or in pairs, sessile or stalked, lateral or terminal; sexual plants not observed.

This is the only species that has a combination of very small diameter of the erect filaments, small monosporangia and an endophytic habit in most part. The plants can usually be located on the host by observing the short erect part that protrudes beyond the host. The erect filaments of A. gracile

are about 5.5μ diam., slightly larger than that of A. islamii. However, the latter has an entirely different habit than the former.

Type locality: Reef Bay, St. John, American Virgin Islands.

Specimen examined: VIRGIN ISLANDS epi-endophytic on Liagora valida, Reef Bay, St. John, Welch, March 26, 1962 (DUKE, TYPE).

ACROCHAETIUM GRACILE Børgesen

Pl. X, Fig. 3

Acrochaetium gracile Børgesen, Dansk Bot. Ark. 3:26. 1915.
Chantransia gracilis (Børgesen) De Toni, Syll. Alg. 54. 1924.

Plants with a creeping filamentous base and sparsely branched, erect filaments arising randomly from the creeping filaments, erect filaments about 5.5μ diam., tapering towards the tip, often ending like a hair; monosporangia linear-oblong, 6-8μ diam., 14-16μ long, usually pedicellate, chiefly borne on the main branches, rarely on short lateral branches; sexual reproduction unknown.

This species was previously known from Virgin Islands, Canary Islands and Viet Nam, on Sargassum, Gelidium, Diplanthera and Gelidiella. This report extends the distribution to North Carolina and Florida on Padina vickersiae, Cladophora sp., and

Rhizoclonium hookeri.

Specimen examined: NORTH CAROLINA on Padina vickersiae in shallow water, Radio Island breakwater, Beaufort, Aziz, August 17, 1962 (DUKE); FLORIDA on Cladophora sp. and Rhizoclonium hookeri, in shallow water, St. Teresa, Franklin County, Humm, July 16, 1955 (DUKE); VIET NAM on Gelidiella myrioclada, rocky shore east of Cu Lav, Dawson, February 17, 1953 (US).

ACROCHAETIUM CAESPITIFORME Børgesen

Acrochaetium caespitiforme Børgesen, Dansk Bot. Ark. 3:446. 1920. Chantransia caespitiformis (Børgesen) De Toni, Syll. Alg. 49. 1924.

Plants epiphytic, base composed of branched filaments, the cells of which are 5μ diam., 8μ long; many erect filaments arise from this basal portion; cells at the base 5μ diam., 12μ long, chromatophore parietal with a single pyrenoid, erect filaments freely branched, gradually tapering upwards; monosporangia linear-oblong, 6μ diam., 11-12μ long mostly pedicellate rarely sessile borne on the upper side of lateral branches; sexual reproduction unknown.

Known only from Virgin Islands, epiphytic on Padina vickersiae.

ACROCHAETIUM GLOBOSUM Børgesen

Acrochaetium globosum Børgesen, Dansk Bot. Ark. 3:28. 1915.

Chantransia globosa (Børgesen) De Toni, Syll. Alg. 53. 1924.

Plants with a basal part of creeping branched filaments, which fuse together to a disc; the cells of the disc irregular in shape, 5-11μ diam., numerous erect filaments arise from the disc, branched, gradually taper towards the tip, cells towards the base 5-6μ diam., 14-30μ long; monosporangia ovate, 7-8μ diam., 8-10μ long, on short opposite branchlets; sexual reproduction unknown.

Known only from Virgin Islands, On Chaetomorpha media.

ACROCHAETIUM LEPTONEMA (Rosenvinge) Børgesen

Chantransia leptonema Rosenvinge, Kgl. Dansk. Videnskab. Selskab. Skrifter, Nat. Og. Mathem. 7(1):118. 1909.

Acrochaetium leptonema (Rosenvinge) Børgesen, Dansk. Bot. Ark. 3:31. 1915.

Plants with a multicellular base usually congested in the center into a pseudoparenchymatous disc, cells of the prostrate filaments 3-4μ diam., short; erect filaments 0.3 mm. tall, simple to sparsely branched, cells 2-3μ diam., 2-5 times as long as broad; monosporangia 5.5-6.5μ diam., 10.0-12.5μ

long, never upto twice as long as broad, borne directly on the prostrate filaments, or on the erect filaments, usually unilateral or terminal, sessile or pedicellate; sexual reproduction unknown.

Known from Bermuda and Florida on larger algae.

ACROCHAETIUM STYPOPODIAE SP. NOV.

Pl. III, Figs. 14-15

Thallus circa 2 mm. altus; pars matura atque adhaerens, epiphytica, unifilio erecte prope 80μ long, supra superficiem hospitis gerente; filia erecta supra ramulosa; ramuli plerumque alterni, rare adversi; filia thalli erecti in medio incrassates, attenuata ad basem atque apicem; cellulae 7.0-10.5μ ad basem, latae diametro circa 6-plo longiores; cellulae ad mediam thalli medio 10-13μ diam. ad apicem thalli 6-8μ diam. 5 plo longiores; monosporangia 10-11μ diam. circa 16μ long.

Hab. in thallo Stypopodii zonalis, on "Alacran Reef," Mexico.

Plants epiphytic, 2 mm. tall; holdfast in young plants composed of a few creeping cells; mature holdfast composed of short, branched filaments, bearing the primary main filament about 80μ above the host surface; erect filaments thickest near the middle of the plant, tapering towards the base and the apex; branching of the erect filaments usually alternate, rarely

opposite; cell walls at the lower parts of the plants thicker than the cell walls in the upper part of the plant; cells 7.0-10.5μ broad near the base, upto 6 times as long as broad; cells at the middle of the plant 10.8-13.0μ diam., at the tip 6-8μ diam., about 5 times as long as broad; cells of the holdfast 5-6μ diam.; cells attached to the substratum, irregular in shape and size; chromatophore parietal with a single pyrenoid; monosporangia, 10-11μ diam., about 16μ long; sexual plants have not been observed.

This is the only species of Acrochaetium known so far in which the holdfast pushes the plant above the substratum. This plant is also distinguished by the slight tapering of the erect filaments from the middle of the plant towards its base and tip.

A. phacelorhizum resembles this species in its general habit. In addition to the above differentiating characters, A. stypopodiae differs from the above mentioned species by having a single erect filament arising from the epiphytic holdfast and by the smaller diameter of the cells of the holdfast. In A. phacelorhizum 2-6 erect filaments arise from an endophytic holdfast and the filaments of the holdfast reach a diameter of 27μ.

Type locality: Alacran Reef, Campeche Banks, southern Gulf of Mexico.

Specimen examined: SOUTHERN GULF OF MEXICO on Stypopodium zonale, in shallow water, west of Isla Perez, Alacran Reef, Aziz and Humm, June 28, 1961 (DUKE, TYPE).

ACROCHAETIUM GALAXAURAE SP. NOV.

Pl. III, Figs. 5-10

Thalli circa 1 mm alti plerumque 0.4-0.6 mm.; partes procumbentes epiphytices, 7-16μ diam., bis longiores quam latae, in forma saepe irregulares; partes erectae 5-10μ diam., ad basem gradatim attenuatae (qualis hyalinum multicellulosum filum, monosporangia 7-8μ diam., 13-15μ long, in stipitibus 1-, 2- vel 3- cellulois gerentibus; bisporangia orientes ex gemmis probabiliter, 8μ diam., 13μ long., ad madiam constricta.

Hab. in thallo Galaxaurae cylindricae, in "Reef Bay, St. John, American Virgin Islands."

Plants upto 1 mm. high, usually between 0.4-0.6 mm.; prostrate filaments in most part larger in diameter than the erect filaments; cells of the prostrate filaments 7-16μ diam., 1-2 times as long as broad, often irregular in shape; erect filaments arise at random from different parts of the prostrate filaments; lower cells of the erect filaments 5-11μ diam., but always smaller in diameter than the cells from which they had arisen; erect filaments gradually taper towards the tip and

often end in a colorless multicellular hair, 3-4μ diameter. Monosporangia borne on 1-, 2- or 3-celled stalks; about 7-8μ diameter, 13.5-18.0μ long.

One spore was observed that had produced a yeast-like bud. One bispore was observed which was probably formed by budding. It was about 8μ in diameter, 13μ long and constricted in the middle. Sexual reproduction was not observed.

A. hormorhizum Børgesen, reported from the Virgin Islands, resembles this species in its habit. However, A. galaxuarae differs from the above-mentioned species by larger diameter of the prostrate filaments, smaller monosporangia and non-moniliform nature of the prostrate part. Bispores are not a constant feature in A. galaxaurae and so it cannot always be used as a differentiating character from A. hormorhizum. However, bispores are not known in the latter species.

Type locality: Reef Bay, St. John, American Virgin Islands.

Specimen examined: VIRGIN ISLANDS on Galaxaura cylindrica in shallow water, Reef Bay, St. John, Welch, March 26, 1962 (DUKE, TYPE).

ACROCHAETIUM SANCTI-THOMAE Børgesen

Acrochaetium sancti-thomae Børgesen, Dansk Bot. Ark. 3:30. 1915. Chantransia sancti-thomae (Børgesen) De Toni, Syll. Alg. 53. 1924. Rhodochorton sancti-thomae (Børgesen) Nakamura, Inst. Alg. Res. Hokkaido Imp. Univ. 2:280. 1941.

Plants epiphytic, base composed of branched creeping filaments, sometimes aggregated into a loose pseudoparenchymatous disc; erect filaments 0.2-0.3 mm. tall, simple or little branched, cells of the erect filaments barrel shaped, 8-9μ diam., 16-18μ long, mostly upto 2 times as long as broad; the tip often ending in a long unicellular hair; monosporangia 7μ diam., 10μ long, oval-obovate, usually sessile; sexual reproduction unknown.

Previously known from Virgin Islands, Florida, Japan and Viet Nam, on Sargassum, Ecklonia, Thalassia, Spyridia filamentosa and Chaetomorpha antennina. This report extends the distribution of this species to Puerto Rico on Chaetomorpha antennina.

The specimens from Puerto Rico are 2 mm. tall, forming conspicuous red tufts on the septa of the host. The main filaments are upto 11μ diam. Unicellular hairs are absent. Monosporangia are sparse. A few clusters of young sporangia have been observed which appear to be the young carposporophyte,

the tip of the young sporangia were beginning to swell up, to form the carposporangia. Two kinds of germinating spores are present which give rise to the same kind of plants. Some of these spores are 14 μ in diam., and the others are 10-11 μ in diam. The large spores are probably carpospores, which germinate by sending a germ tube much smaller than their own diameter. The smaller spores (monospores) usually divide to give rise to two cells which are half as long as broad immediately after division. Either one of these cells gives rise to an erect filament or both of them first give rise to a few prostrate cells which then produce one or more erect filaments. It is likely that plants of intermediate sizes (0.3-2 mm.) will be found upon the examination of more materials. It is with this reasoning that the author is not treating the specimens from Puerto Rico as a new variety. The author is of the opinion that the specimens from Puerto Rico were robust plants of A. sanctae-thomae.

Specimens examined: VIRGIN ISLANDS on Sargassum vulgare, St. Thomas Harbor, Børgesen, December 21, 1905 (NY); PUERTO RICO on Chaetomorpha antennina near Institute of Marine Biology, Mayaguez, Blomquist and Almodover, April 16, 1958 (DUKE); VIET NAM on C. antennina on heavily beaten "Black Rocks" near Institut oceanographique de Hatrang, Dawson, February 6, 1953 (US).

ACROCHAETIUM BISPORUM (Børgesen) Børgesen

Chantransia bispora Børgesen, Bot. Tidsskr. 30:178. 1910. Acrochaetium bisporum (Børgesen) Børgesen, Dansk. Bot. Ark. 3: 43. 1915.

Plants with an epi-endophytic base composed of free branched filaments; erect filaments radially alternately branched; cell 8μ diam., 20μ long with a single pyrenoid; monosporangia ovate-oblong, 6μ diam., 10μ long mostly sessile; bisporangia oval 9μ diam., 14μ long; sexual reproduction unknown.

Known only from Virgin Islands on Acanthophora spicifera.

ACROCHAETIUM HUMMII SP. NOV.

Pl. VIII, Figs. 1-6; Pl. IX, Figs. 1-4; Pl. X, Fig. 4

Named after Dr. Harold J. Humm, Associate Professor of Botany, Duke University, Durham, North Carolina, who first suggested to the writer a project on the genus Acrochaetium in Beaufort, North Carolina, and vicinity. His enthusiasm and interest encouraged the writer to pursue the problem further and thus be able to present this dissertation.

Thalli usque 0.5 mm. alti, plerumque 0.2-0.3 mm.; discus ex filis epiphyticis, ramosis repentis compositus, interdum in medio pseudoparenchymatious; filis erectis ramosis, maxime variabilis, secundis, alternis vel adversis; ad apicem ex ramis saepe pili hyalini adsunt; cellulae filis erectis plerumque 6-8μ latae, diametro 1.5-3.0, plo longiores; chromatophorum singulare, plerumque parietale, interdum stellum, uninucleate, pyrenoide solitaris; mono-, bi-, tri-sporangia asexuales, sessiles pedicellates, rare ad apicibus aggregata; monosporangia ovata aut ovati-oblonga 7-10μ diam., 18-20μ long; trisporangia 7-10μ diam., 23-27μ long; thalli sexulaes rari; spermatangia 3-5μ diam., 5-7μ long. plerumque sessiles rare pedicellates, solitaria aut binaria; carpogonia solitaria usque 21μ long., ad basem 4-5μ diam., trichogyna circa 13μ long; carposporangia et monosporangia similares. Hab. Epiphytic in algas varicas, Beaufort, North Carolina.

Plants 0.5 mm. tall, usually between 0.2 mm. and 0.3 mm.; holdfast composed of epiphytic, branched, creeping filaments, sometimes quite extensive, rarely aggregated into a pseudoparenchymatous disc in the center; the branching habit of the erect filaments extremely variable; branching usually moderate in the upper part of the erect filaments, often sparse, sometimes highly branched; secund, alternate or opposite;

filaments tapering slightly towards the tip; often ending in a distinct colorless unicellular hair; cells of the erect filaments usually 6-8μ diam., 1.5-3.0 times as long as broad; rarely cells 13μ diam., as long as or slightly longer than broad; cells with single chromatophores, chromatophore usually parietal but sometimes stellate; uninucleate and with single pyrenoids. Asexual reproduction by mono-, bi-, or tri-sporangia, all borne on the same plants; secund, alternate or rarely opposite, sessile or pedicellate often the sporangia being borne on the upper part of the filaments, rarely in terminal clusters; monosporangia ovate to ovate-oblong, 7-10μ diam., 10-13μ long; bisporangia about the same diameter as the monosporangia, 18-22μ long, trisporangia about the same diameter as mono- or bi-sporangia, 23-27μ long; sexual plants rare, found only after extensive search; spermatangia borne laterally on the filaments, solitary, or in pairs, usually sessile, rarely stalked, 3.5μ diam., 5-7μ long; carpogonia solitary 21μ long, 4-5μ diam., near the base, trichogynes about 13μ in length; carpogonia after fertilization giving rise to single carposporangia, not distinguishable from monosporangia; gonimoblast filaments absent.

The germinating cells first divide into two initial cells. One or both of these cells either give rise to the erect filaments or to the creeping filaments, or both these

initial cells germinate at the same time. Sometimes a few prostrate cells are produced first, which then produce one or more erect filaments. Sometimes out of the two initial cells mentioned above, one of them gives rise to both the erect and the prostrate filaments, while the other does not divide for some time. The specimens examined include all stages of development from a germinating spore to mature plant.

Trispores have not been reported before in the genus Acrochaetium and thus A. hummii can easily be distinguished from the rest of the species based on this character alone. This species resembles A. virgatulum from which it can be differentiated by the presence of bispores or trispores and by the absence of parenchymatous disc-like holdfast.

This minute species grew in such abundance on various algae, especially on Chaetomorpha aerea, that in several jetties in Fort Macon, North Carolina, the rocks of the intertidal zone appeared red in early April 1964. Chaetomorpha aerea which is normally a bright green alga appeared entirely red by the overgrowth of A. hummii, on it. A color slide has been included along with the type specimen deposited in the Duke University Herbarium.

Type locality: Beaufort, North Carolina.

Specimens examined: NORTH CAROLINA on Amphiroa brasiliana, intertidal zone, Cape Lookout, Aziz, August 15, 1962 (DUKE); on Sargassum filipendula and Punctaria plantaginea, near the sea wall of U.S. Fish and Wildlife Laboratory, Beaufort, Aziz, April 6, 1963 (DUKE); On S. filipendula, P. plantaginea, Gracilaria foliifera, Polysiphonia nigrescens, Chaetomorpha aerea and Gelidiopsis sp. in the intertidal zone, Fort Macon, near Beaufort, Aziz and Shaio, January 29, 1964 (DUKE); on Chaetomorpha aerea, Polysiphonia nigrescens and most other intertidal algae, on intertidal rocks, Fort Macon, near Beaufort, Aziz and Shaio, April 12, 1964 (DUKE, TYPE on Chaetomorpha aerea).

ACROCHAETIUM SERIATUM Børgesen

Pl.XIII, Figs. 1-2

Acrochaetium seriatum Børgesen, Dansk Bot. Ark. 3:32. 1915.
Chantransia seriatum (Børgesen), De Toni, Syll. Alg. 53. 1924.

Plants epiphytic, holdfast composed of irregularly bent creeping filaments, sometimes aggregated into a disc in the center; erect part 1 mm. tall; cells of the main filament 8-10μ diam., about 2 times as long as broad; monosporangia 6-9μ diam., 9-13μ long, oblong-ovate, mostly sessile borne in long secund series; sexual reproduction unknown.

Known from Virgin Islands, Florida, Texas, Ship Island (Mississippi Sound), East Indies and Mexico; on Posidonia, Diplanthera, Thalassia, Syringodium, Gelidium crinale, Gracilaria foliifera, Sargassum filipendula.

A similar secund series of sporangial arrangement was observed by the author in some specimens of A. sagraeanum from Miami, Florida, and Alacran Reef Mexico. The size of the monosporangia in these specimens is 12-14μ diam., 19-22μ long and thus could easily be separated from A. seriatum.

Sporangia are sparse in the specimens from Deer Island, Mississippi. The author could not come to a definite conclusion as regards the identification of these plants because of the absence of such a prominent character. However, the dimensions of the erect filaments agreed with that of A. seriatum.

Specimens examined: NORTH CAROLINA on Chaetomorpha aerea, intertidal zone, Fort Macon, near Beaufort, Aziz, June 27, 1960 (DUKE); MISSISSIPPI on Diplanthera in shallow water, Deer Island Mississippi Sound, Schuster, July 17, 1951 (DUKE); on Gelidium from sides of sunken iron barge, western end of Ship Island, Mississippi Sound, Humm, August 12, 1955 (DUKE); on Diplanthera wrightii in shallow water towards the West end of Horn Island on the inshore side, Channell, June 12, 1959 (collections of R.B. Channell).

ACROCHAETIUM FLEXUOSUM Vickers

Acrochaetium flexuosum Vickers, Ann. Sci. Nat. ser. 9, Bot. 1: 60. 1905.

Chantransia flexuosa (Vickers) Collins, Rhodora 13:186. 1911.

Plants with dense tufts of erect filaments 700μ high which arise from a base of creeping filaments, the latter sometimes pseudoparenchymatous in the center; erect filaments highly branched; cells in the lower part 9-10μ diam., 18-35μ long, in the upper part 6-7μ diam., 30-35μ long, chromatophore parietal with large pyrenoid; monosporangia ovate oblong 9-10μ diam., 14-16μ long, borne on the upper side of the branches, sometimes in series; sexual reproduction unknown. This species is previously known from Virgin Islands, Barbados, New Jersey, Rhode Island and Massachusetts, on Caulerpa paspaloides, Sargassum, Halophila, Laurencia intricata, Cladophora fascicularis and other algae. This report extends the distribution of this species to North Carolina and Jamaica on Chaetomorpha melagonium, C. antennina and coral.

This species closely resembles A. sagraeanum in its habit, from which it can be differentiated by its smaller monosporangia. The plants found in Humm's Jamaica collections are about 2 mm. in height but agree with the description of A. flexuosum in other respects.

Specimens examined: NORTH CAROLINA on Chaetomorpha, in shallow water, Fort Macon, near Beaufort, Aziz, June 27, 1960 (DUKE); JAMAICA on dead coral, Doctors Cove, Montego Bay, Humm, May 22, 1962 (DUKE); on Chaetomorpha antennina, Port Antonio, Wight (FH).

ACROCHAETIUM SAGRAEANUM (Montagne) Bornet

Pl.XII, Figs. 1-2

Cladophora sagraeana Montagne, Syll. Gener. 450. 1856.
Acrochaetium sagraeanum (Montagne) Bornet, Bull. Soc. Bot. France XXI. 1904.
Chantransia sagraeana (Montagne) De Toni, Syll. Alg. 51. 1924.

Plants epiphytic, with a base of contorted filaments entangled with each other; erect part 2-6 mm. tall, numerous erect filaments arising from the prostrate part; cells of the main filaments 12μ diam., 4-8 times as long as broad; filaments gradually tapering towards the apex; monosporangia 8-10μ diam., 18-22μ long, sometimes secund, sessile or pedicellate; tetrasporangia rare, 17-27μ diam.; 28-34μ long; sexual reproduction unknown.

Previously known from Florida, West Indies, Bermuda, New England and Mexico; on Zostera, Stypopodium, Dictyopteris, Ruppia and Thalassia. This report extends the distribution of

this species to North Carolina and Southern Gulf of Mexico on Champia parvula, Gracilaria foliifera; and Stypopodium zonale.

This species is closely related to A. flexuosum from which it can be differentiated by its larger monosporangia. Tetrasporangia are absent in A. flexuosum.

The specimens from Fort Macon and Cape Lookout, North Carolina, are often so congested that they form a pseudoparenchymatous disc. Tetrasporangia are found in the plants from Fort Macon and Bermuda, but are rare in these plants, which mostly bear monosporangia. The branching of some of these plants is more abundant than previously reported.

Specimens examined: NORTH CAROLINA on Champia parvula, lower intertidal zone, Shackleford breakwater, near Beaufort, Aziz, June 19, 1960 (DUKE); on Gracilaria foliifera in shallow water, Fort Macon, near Beaufort, Aziz and Shaio, January 29, 1964 (DUKE); FLORIDA on Cymodocea sp., in shallow water, Biscayne Bay, Miami, Aziz and Humm, September 1, 1960 (DUKE); on Cymodocea sp. in shallow water, Largo Sound, Aziz and Humm, May 30, 1961 (DUKE); on Sargassum bermudense in shallow water, St. Teresa, Franklin County, Humm, July 16, 1955 (DUKE); on Cladophora sp. from shelly bottom near whistle buoy 26, in 35 ft. of water, nine miles southeast of Alligator Point, Franklin County, Humm, July 7, 1952 (DUKE); SOUTHERN GULF OF MEXICO on

Stypopodium zonale in shallow water at the windward side of Alacran Reef, Aziz and Humm, June 26, 1961 (DUKE); BERMUDA on Dictyopteris justii, Buildings Bay, Hervey, July 24, 1914 (US); CONNECTICUT Stratford, Fairfield County, Holden, September 1892 (FH).

ACROCHAETIUM ROBUSTUM Børgesen

Pl.XIII, Fig. 3

Acrochaetium robustum Børgesen, Dansk Bot. Ark. 3:40. 1915.
A. sargassicolum Børgesen, Kew Bull. 115, 1932.
Rhodochorton robustum (Børgesen) Nakamura, Inst. Alg. Res. Hokkaido Imp. Univ. 2:284. 1941.

Plants epi-endophytic, base of the plant a thick walled pseudoparenchymatous multicellular disc with a thick walled unicellular endophytic process, about 20μ long; numerous erect filaments arise from the disc, sparingly branched; cells 9-10μ diam., 1.5-2.0 times as long as broad below, 5μ diam., upto 40μ long above; monosporangia 11μ diam., 14-16μ long with wall upto 2μ thick, oval-ovate; sexual reproduction unknown.

Previously known from North Carolina, Virgin Islands, Japan, Hong Kong, India, Ceylon and Viet Nam; on Sargassum, Codium, Turbinaria, Padina and Stoechospermum. This report extends the distribution of this species to Virginia, Puerto

Rico and Jamaica; on Gracilaria foliifera and Acanthophora spicifera.

Specimens examined by the author from Puerto Rico and Jamaica are 1.5 mm. high. Plants observed by Børgesen were 1 mm. high. The specimens from North Carolina had large basal discs and it is difficult to locate the basal endophytic process.

Specimens examined: NORTH CAROLINA on Rhodymenia pseudopalmata, in shallow water, Cape Lookout, Aziz, August 15, 1962 (DUKE); VIRGINIA on Gracilaria foliifera, from inside Cedar Island, Wachapreague, Castagnea, November 2, 1962 (DUKE); VIRGIN ISLANDS on Sargassum vulgare in sheltered place, St. Thomas Harbor, Børgesen, December 21, 1905 (NY); PUERTO RICO on Acanthophora spicifera, Guaynilla, Almodover, May 21, 1961 (DUKE); JAMAICA on Acanthophora spicifera, Doctors Cove, Montego Bay, Humm, May 22, 1962 (DUKE); VIET NAM on Sargassum sp. cua Be, Dawson, January 30, 1953 (US).

ACROCHAETIUM ANTILLARUM Taylor

Acrochaetium antillarum Taylor, Allen Hancock Exped. 78. 1942.

Plants epi-endophytic, in most part creeping between the host membrane, cells of the creeping portion irregular in form, 4.5-5.2 μ diam., 8-15 μ long, chromatophore probably axial,

with a single pyrenoid; erect filaments simple or with a few branches, cells 4.0-5.7μ diam., 5.7-8.0 (-12.6)μ long; monosporangia terminal on 1-4 subcorymbiform branches, oval, 7.5-8.5μ diam., 10.5-12.5μ long; sexual reproduction unknown.

Known only from Tobago, on Bryopsis.

ACROCHAETIUM DAVIESII (Dillwyn) Nägeli

Conferva daviesii Dillwyn, British Confervae 73. 1809.

Callithamnion mirabile Kützing, Species Algarum 639. 1849.

Callithamnion daviesii (Dillwyn) Harvey, Phycologia Britannica 314. 1851.

Acrochaetium daviesii (Dillwyn) Nägeli, Sitzber. Acad. Wiss. München 2:405. 1861.

Chantransia daviesii (Dillwyn) Thuret, Liste alg. mar. cherb. 103. 1863.

Plants epiphytic, holdfast creeping, filamentous and branched which often becomes extensive on the substratum; erect part to 6 mm. tall; main filaments 7-13μ diam.; monosporangia lateral, sessile, or with short stalks, 8-12μ diam., 11-20μ long, bisporangia absent; reproduction by tetraspores known.

Previously known from North Atlantic, Mediterranean, California, Revilla-gigedo Island (Pacific Mexico), Stuart Islands (New Zealand), Tristan da Cunha and Inaccessable Island.

On Cystoseira, Caulerpa, Griffithsia and Cladophora. This record extends the distribution of this species to Jamaica and Oregon, on corals and Macrocystis integrifolia.

Sexual reproduction has not been reported for this species. Among specimens collected in Jamaica in 1962 by H.J. Humm, one plant was observed with a cluster of mature carpospores borne terminally on the gonimoblast filaments. The cluster observed was lateral and 43μ high. Carpospores are 10μ in diameter and 14μ long. Of the few monosporangia observed, some of them were terminal.

Specimens examined: MAINE on Rhodymenia palmata, at low water mark, Muscongus Bay, Bristol, Collins, July 15, 1901 (FH as Chantransia daviesii); JAMAICA on crevices of dead corals, Doctors Cove, Montego Bay, Humm, May 18, 1962 (DUKE); OREGON on the main stipe of Macrocystis integrifolia, drifted specimen in a rock pool. Simpson Reef, Cape Arago, Aziz, July 22, 1963 (DUKE); PACIFIC MEXICO on Caulerpa racemosa from lower tide pools and sublittoral zone, Sulphur Bay, Clarion Island, Revillagigedo Islands, Taylor, January 5, 1934 (FH).

ACROCHAETIUM RENIFORME SP. NOV.

Pl.III, Figs. 1-2

Thallus usque 1.5 mm. altus, filis crescentibus Liagorae validae ad sporam primam adhaerentibus; sporae primae thallo-

rum adulescentorum distinctae, sed ut videtur, tandem in positum in tallis maturis; cellulae filorum erectorum plerumque 8-10μ latae diametro 6-7 plo longiores, sed interdum cellulse usque 16μ latae diametro 3-4 -plo longiores, uninucleatae; chromatophorum parietale pyrenoide solitatio; monosporangiis reniformibus, hilum supra mediam sporae positum, latiore ad basem 14-17μ latibus, 19-21μ longibus.

Hab. in Reef Bay, St. John, American Virgin Islands.

Plants 1.5 mm. tall, attached to the assimilatory filaments of Liagora valida by the original spore; original spore distinct in young plants by its larger diameter but in mature plants it could be located only by its position; spore, on germination, give rise to an epiphytic filament at one end and an endophytic one at the other end; young plants with an unbranched erect filament, sometimes 0.6 mm. tall; branching start some distance above the base; moderate and alternate; erect filaments taper very little towards their apex; cells of the erect filaments usually 8-10μ diam., 6-7 times as long as broad, but sometimes upto 16μ diam., 3-4 times as long as broad, uninucleate with a single parietal chromatophore and a single pyrenoid; monosporangia kidney shaped, the notch being placed a little above the middle part of the spore, broader towards the base than the upper part, 14-17μ diam., at the broadest part, 19-21μ long; sexual plants not observed.

No other species of Acrochaetium is known with kidney shaped sporangia, thus A. reniforme can easily be distinguished. The nature of the endophytic part of the plant is also distinctive.

Type locality: Reef Bay, St. John, American Virgin Islands.

Specimen examined: VIRGIN ISLANDS. Epi-endophytic on the assimilatory filaments of Liagora valida, Reef Bay, St. John, Welch, March 26, 1962 (DUKE, TYPE).

ACROCHAETIUM COMPTUM Børgesen

Acrochaetium comptum Børgesen, Dansk Bot. Ark. 3:46. 1915.
Chantransia compta (Børgesen) De Toni, Syll. Alg. 40. 1924.

Plants epi-endophytic, germinating spore divided by a transverse wall into two cells and remaining distinct, the upper cell giving rise to the erect filaments, free and branched above, the lower cell giving rise to the endophytic creeping part; the cells of the erect part 8-11 μ diam., 35 μ long; chromatophore parietal with a pyrenoid, the erect filaments gradually tapering towards the tip; monosporangia 11-14 μ diam., 18 μ long, broad oval, placed upon short secund branches, usually pedicellate, borne singly or in pairs, sessile monosporangia more common in the upper part of the plant, sexual reproduction unknown.

Known from Virgin Islands and Brazil. The author has observed one plant from Florida but no voucher specimen could be prepared.

ACROCHAETIUM BORNETII Papenfuss

Chantransia corymbifera Thuret in Le Jolis, Mem. Soc. Sci. Nat. de Cherb. 10:107. 1863.
Acrochaetium corymbiferum (Thuret) Batters, J. Bot. 40:59. 1902.
Rhodochorton corymbiferum (Thuret) Drew, Univ. Calif. Pub. of Botany 14:183. 1928.

Plants with an endophytic filamentous base, original spore persistent, 12-15μ diam., distinct; erect filaments many, branched, 8-16μ diam., slightly tapering towards the tip; reproduction both asexual and sexual; monosporangia oblong; carposporangia in clusters on the gonimoblast filaments; spermatangia, carpogonia and monosporangia borne in different plants.

This species most closely resembles A. dasyae in its habit. However, in A. dasyae monosporangia are borne by both male and female plants.

Known from Northeastern Atlantic, North Carolina, Bermuda and California on Helminthocladia, Thuretella, Dudresnaya and Dasya.

Specimens examined: NORTH CAROLINA on Dasya pedicellata, Beaufort harbor, Hoyt, May 20, 1907 (DUKE, as Acrochaetium corymbiferum); BERMUDA on Dudresnaya crassa Shelly Bay, Collins, May 4, 1912 (SI, as Chantransia corymbifera).

ACROCHAETIUM ALACRANENSE SP. NOV.

Pl.III, Fig. 11, Pl.XV, Fig. 1

Thalli circa 1 mm. alti, epi-endophytici in Galaxaura sp.; spora prima fili crescentis hospitis adharente, file repente endophytico atque filo erecto ferente; unum filum vel plus fili erecto plerumque in cellulis erectibus endophyticis propinquius sporam priman ferentibus; cellulae circa 8μ latae diametro 3-4 plo longiores atque cellulae filiorum erectorum similiaiares; monosporangia distincte pyriformes, circa 10μ diam. atque in partibus latibus circa, 16μ long.

Hab. Alacran Reef, Mexico in Galaxaura sp.

Plants about 1 mm. tall, growing epi-endophytically on Galaxaura sp.; original spore attached to the assimilatory filaments of the host, bearing one creeping endophytic filament; one or more erect filaments usually borne on the endophytic cells adjacent to the original spore; cells about 8μ diam., 3-4 times as long as broad and of about the same dimensions throughout the erect filaments; the apical cell of the erect filament usually shorter than the rest of the cells and rounded at the

top; endophytic filaments gradually taper toward the apical cell and acute at the tip; monosporangia distinctly pyriform, about 10μ diam. at the broadest part and about 16μ long; sexual plants not observed.

This species can be distinguished by its mode of attachment to the assimilatory filaments of Galaxaura and by the distinctly pyriform monosporangia.

Type locality: Alacran Reef, Campeche Banks, southern Gulf of Mexico.

Specimen examined: SOUTHERN GULF OF MEXICO: On the assimilatory filaments of Galaxaura sp., in shallow water, Isla Perez, Alacran Reef, Campeche Banks, Aziz and Humm, June 29, 1961. (DUKE, TYPE).

ACROCHAETIUM DASYAE Collins

Pl. I, Pl. VI, Figs. 1-2; Pl. VII, Figs. 1-5

Acrochaetium dasyae Collins, Rhodora 8:191. 1906.
Chantransia dasyae (Collins) Collins, Rhodora 13:186. 1911.
Acrochaetium intermedium Jao, Bull. Torrey Bot. Club 63:242. 1936.

Plants with a swollen basal cell of a peculiar shape comprised of the original spore which usually gives rise to a descending filament, sometimes branched; erect filaments 6-8μ diam., branched; monosporangia 9μ diam. and 16μ long. Collins (1906) reported this species on Dasya elegans (D. pedicellata).

This species was previously known only from Massachusetts. The present report extends the distribution of this species to Virginia, North Carolina and Florida.

Jao (1936, p. 242) described A. intermedium on Dasya pedicellata, based on material which was past its full maturity. Jao (p. 243) stated the differences between A. dasyae and A. intermedium as: "... [A. intermedium] differs from the first in having an endophytic base, an elongated basal cell (original spore) often with rhizoidal filaments penetrating into the cell wall of the host, greater dimensions of all cells and much more abundant branching."

The author has examined a large number of specimens from various localities at different times. It appears that Collins observed young plants and Jao observed the old plants of the same species. Collections from Fort Macon in January 1964 contain young plants of Acrochaetium that correspond to A. dasyae Collins and the specimens collected from Shackleford in April 1964 agree with the description of A. intermedium Jao. The author is of the opinion that A. intermedium Jao is a synonym of A. dasyae Collins.

Sexual reproduction has not been reported before in this species. Abundant male and female plants are present in the April 1963 and April 1964 collections from the North Carolina coast.

Spermatia are borne on a specialized lateral branch. At first this branch produces short secund branches which sometimes produce a second set of secund branches. The last order of branches is usually dichotomous. In each subsequent order of branching, the cells decrease in length and breadth. At the very tip of each branchlet of the last order, one spermatium is borne. The spermatia are 2.5-4μ in diameter and 3-5μ long, rarely larger. The spermatangial branches are usually 15-80μ long. Spermatangial branches are developed either from every cell of a short branch, secund on the abaxial surface of the filament, or alternate on a long branch.

After the fertilization of the egg, several gonimoblast filaments develop from the zygote. These filaments are usually once or twice, sometimes 3 times branched. At maturity they look like a cluster of branches. Cells of these filaments are about 8μ in diameter, mostly as long as broad. As these filaments mature the tip cells start swelling and finally give rise to carpospores. The mature carpospores are 13-15μ broad, 16-22μ long. Asexual reproduction is by monospores borne by male and female plants with varying abundance. The monosporangia are 13-16μ diam., 21-26μ long. Jao reported the monosporangia to be 9-13μ diam., 19-23μ long.

Specimens examined: NORTH CAROLINA, on Dasya pedicellata, in shallow water Pivers Island, Beaufort, Aziz,

April 6, 1963 (DUKE); Radio Island Breakwater, near Beaufort, Aziz, April 5, 1963 (DUKE); Fort Macon, near Beaufort, Aziz and Shaio, January 29, 1964 (DUKE); Fort Macon, near Beaufort, Aziz and Shaio, April 11, 1964 (DUKE); FLORIDA, on Dasya pedicellata mouth of Homosassa River, 2 miles offshore at 5 ft. depth, J. and S. Taylor, L. and A. Earle, April 13, 1964 (DUKE); VIRGINIA, on Dasya pedicellata, Broad Bay, Virginia Beach, DeWitt, April 10, 1949 (DUKE); MASSACHUSETTS, Woods Hole, Collins, September 2, 1905 (FH).

ACROCHAETIUM RADIANS Hamel

Acrochaetium radians Hamel, Recher. genres Acroch. Naeg. Rhodoch. Naeg. 74. 1927.

Plants with a round persistent, original spore about 10μ diam., which gives rise to a creeping base; erect filaments 1 mm. tall, little branched; cells below 6-10μ diam., 2-4 times as long as broad, above 3μ diam., to 35μ long; monosporangia 7-10μ diam., 10-12μ long, ovate, in clusters or lateral series, or terminal on short branches, usually stalked; sexual reproduction unknown.

Known only from Guadaloupe.

ACROCHAETIUM OCCIDENTALE Børgesen

Acrochaetium occidentale Børgesen, Dansk Bot. Ark. 44. 1915.

Chantransia occidentalis (Borgesen) De Toni, Syll. Alg. 69. 1924.

Plants epi-endophytic, base with distinct spherical original spore about 16μ diam., which give rise to one or more endophytic filaments; on the other end of the spore a single primary erect filament arise, much branched above; cells 10-11μ diam., 27-40μ long; branches slightly tapering above; monosporangia 9-12μ diam., 18-20μ long, oval-ovate, sessile; bispores rare; sexual reproduction unknown.

Known from Virgin Islands and Canary Islands on Liagora.

ACROCHAETIUM CHONDRIAE SP. NOV.

Pl.IV, Figs. 1-2; Pl.V, Figs. 2-4

Thalli usque 2 mm. alti; cellulae ad basem filis erectis aut 8-13μ lati diametro 2-6 plo longiores aut 16-20μ lati diametro 1-2 plo longiores; filis partis erectae in parte superiore similaribus, 13-16μ latis, diametro 4-6-plo longioribus; chromatophorum parietale; discus basalis endophyticus, aut ex filis repentis aut ex filis erectis compositus; cellulae in parte endophytice maxime variabiles, 7-20μ lates, diametro 1.0-3.5- plo longiores; monosporangia

plerumque pedicellate, 13-16μ lata, 23-24μ longa.

Hab. in Chondriae cnicophilae, in flumene Homosassa, Florida.

Plants 2 mm. tall with two or more erect filaments; erect filaments usually of two kinds: holdfast, when young, of a few short endophytic creeping cells, at maturity, a branched filament, creeping parallel to the host surface; from this part, one or more endophytic filaments grow perpendicular to the host surface, which penetrate deep into the host tissue; the appearance of this perpendicular filament extremely variable; thin erect filaments 8-13μ diam., 2-6 times as long as broad towards the base; thick erect filaments at the base 16-21μ diam., 1-2 times as long as broad; main filaments of both kinds similar in the upper parts, having a diameter of 13-16μ, 4-6 times as long as broad; branches of second and third order slightly less in diameter, but not tapering into a multicellular hair; branching alternate, rarely opposite; cells of the endophytic filaments perpendicular to the host surface very variable in size and shape, in one extreme upto 21μ diam., as long as, or slightly longer than broad, almost moniliform, on the other extreme 7-8μ diam. 2.5-3.5 times as long as broad and more or less cylindrical; cells of the part of the holdfast creeping parallel to the surface of the host 8-10μ diam., 1-2

times as long as broad, sometimes irregular in shape, each cell containing a single parietal chromatophore with a prominent pyrenoid and a nucleus; nuclei about 2.7μ diam.; monosporangia, usually stalked, 13-16μ diam., 23-24μ long; sexual plants not observed.

The endophytic part does not stain much, either by acetocarmine or by Harris' haematoxylin. The erect part takes stain readily. Only the nucleus of the prostrate part takes stain in most cases. This species is distinguished by two kinds of endophytic filaments that forms the holdfast, one kind parallel to the host surface, the other perpendicular.

Type locality: Two miles offshore from the mouth of Homosassa River, Florida Gulf coast.

Specimen examined: FLORIDA, on Chondria cnicophila, in 5 ft. of water, two miles offshore from the mouth of Homosassa River, Mr. and Mrs. Taylor, and Mr. and Mrs. Earle, April 13, 1963, (DUKE, TYPE).

ACROCHAETIUM PHACELORHIZUM Børgesen

Acrochaetium phacelorhizum Børgesen, Dansk Bot. Ark. 54. 1915. Chantransia phacelorhiza (Børgesen) De Toni, Syll. Alg. 65. 1924.

Plants epi-endophytic with base in part, of thick vertical filaments congested together, in part, free, branched,

sometimes extensive, vertically penetrating into the host tissue, erect part 1 mm. diam., erect filaments many from the holdfast, highly branched, cells 11-15μ diam. below, 6-7μ diam. above, about 40μ long below, 54μ long above; monosporangia 12-14μ diam., 22-25μ long, often with a small thickening at the tip, oblong, sessile; sexual reproduction unknown.

Known from Virgin Islands and Florida on Codium.

ACROCHAETIUM AVRAINVILLEAE Børgesen

Acrochaetium avrainvilleae Børgesen, Dansk Bot. Ark. 3:48. 1915. Chantransia avrainvilleae (Børgesen) De Toni, Syll. Alg. 52. 1924.

Plants 1 mm. tall; basal part of short creeping filaments attached to the surface of the filaments of the host plant; erect filaments arise from the middle of the basal filaments; cells in the lower part 5.5μ diam.; in the middle, 9μ diam., 33μ long; in the upper part 4μ diam., 50μ long; chromatophore parietal with a prominent pyrenoid; monosporangia sessile, rarely pedicellate, oblong elliptic, 10-11μ diam., 20-22μ long; sexual reproduction unknown.

Known only from Virgin Islands, on Avrainvillea nigricans.

ACROCHAETIUM HORMORHIZUM Børgesen

Acrochaetium hormorhizum Børgesen, Dansk Bot. Ark. 3:50. 1915.
Chantransia hormorhiza (Børgesen) De Toni, Syll. Alg. 65. 1924.

Plants epi-endophytic, endophytic filaments branched with thick walled moniliform cells, 11μ diam., 12-14μ long; many erect filaments arise from the endophytic part; erect filaments 1 mm. in height, moderately branched; cells in the lower part of the erect filaments 9-11μ diam., 30-50μ long, above 8-9μ diam., about 60μ long; monosporangia oblong-elliptic 10-11μ diam., 20-22μ long mostly sessile.

Known only from Virgin Islands, on Champia parvula.

ACROCHAETIUM REPENS Børgesen

Acrochaetium repens Børgesen, Dansk Bot. Ark. 3:52. 1915.
Chantransia repens (Børgesen) De Toni, Syll. Alg. 64. 1924.

Plants epi-endophytic, base filamentous, creeping below the host surface, cells of the endophytic filaments conspicuously irregular in size and shape; the erect filaments scattered, 0.5 mm. tall, little branched, tapering into almost hyaline hair like tip; cells of the erect part 7-8μ diam., about 24μ long below, 2-3μ diam., 50μ or more long above; monosporangia 8μ diam., 14μ long, oblong, usually pedicellate; sexual reproduction unknown.

Known only from Virgin Islands, on Hypnea and Griffithsia.

ACROCHAETIUM HYPNEAE (Børgesen) Børgesen

Pl.II, Fig. 18; Pl.X, Figs. 1-2

Chantransia hypneae Børgesen, Bot. Tidsskr. 30:2. 1909. Acrochaetium hypneae (Børgesen) Børgesen, Dansk Bot. Arkiv. 3: 51. 1915.

Plants epi-endophytic; endophytic filaments short, little branched; one to several erect filaments arising from the base, cells of the main filament 7-10μ diam., monosporangia 7-9μ diam., 10-12μ long, usually sessile; sexual reproduction unknown.

Previously known from Virgin Islands, and Bermuda on Hypnea and Centroceras. This report extends the distribution of this species to North Carolina and Southern Gulf of Mexico on Polysiphonia howei and Hypnea musciformis.

Specimens collected by the author from Cape Lookout, North Carolina, grow on Polysiphonia howeii; those from Alacran Reef are on Hypnea musciformis. In these specimens monosporangia are sessile, on one-celled stalks or terminal. The sessile monosporangia exhibit a peculiar shape that is easily recognized but difficult to describe and includes a

distinct constriction at the base. Most of the monosporangia are 10.5μ diam., 13.0μ long, larger in size than previously reported.

The specimens from Alacran Reef are probably a variation from the type material. In these plants the cells of the main filaments are about 6μ diam. and upto 7 times as long as broad. Consequently the appearance of the Alacran specimens is different, but in other respects they agreed quite well with A. hypneae.

Specimens examined: NORTH CAROLINA, on Hypnea musciformis, lower intertidal zone, Shackleford breakwater, near Beaufort, Aziz, July 4, 1960 (DUKE); on Polysiphonia howei in shallow water, Cape Lookout, Aziz, August 15, 1962 (DUKE); SOUTHERN GULF OF MEXICO, on Hypnea musciformis, in shallow water, Isla Perez, Alacran Reef, Aziz and Humm, June 29, 1961 (DUKE).

ACROCHAETIUM NEMALIONIS (De Notaris) Bornet

Callithamnion nemalionis De Notaris in Ardissone, Prosp. Ceram. Ital. 17. 1867.

Chantransia saviana Ardissone, Phycol. Medit. 276. 1883.

Chantransia nemalionis (De Notaris) Ardissone & Strafforello, Enumer. Alg. Ligur. 167. 1877.

Acrochaetium nemalionis (De Notaris) Bornet, Bull. Soc. Bot. France XX. 1904.

Plants epi-endophytic, endophytic filaments loosely dispersed within the host, branched; the erect part 5 mm. in height, erect filaments about 10μ diam., sparsely branched below, highly branched above, tips of branches attenuate, hairlike; monosporangia 9-10μ diam., 18-19μ long, usually stalked, solitary or 2-3 on the same stalk; sexual reproduction unknown.

Known from Bermuda, Denmark, Mediterranean and Canary Islands, on Nemalion, Liagora and Tamarix.

ACROCHAETIUM INFESTANS Howe & Hoyt

Pl. II, Fig. 17

Acrochaetium infestans Howe & Hoyt, Mem. New York Bot. Gard. 6:116. 1916.

Chromastrum infestans (Howe & Hoyt) Papenfuss, Univ. Calif. Pub. Bot. 18:324. 1945.

Kylinia infestans (Howe & Hoyt) Papenfuss, Univ. Calif. Pub. Bot. 18:438. 1947.

Plants epi-endozoic, known only on hydroids, endozoic filaments extensive, sometimes aggregated into subparenchymatous structures; cells of the prostrate part 9-13μ diam., 7.0-14.5μ long, irregular in shape and size, usually with many discoid or

elongated chromatophores; erect filaments upto 170μ high, 4.5-6.5μ diam. often ending in hairlike prolongations; monosporangia 6.0-8.5μ diam., 10-14μ long, ovoid or ellipsoid, sessile or pedicellate; sexual reproduction unknown.

Known from North Carolina, North Africa, Bermuda and Florida.

On hydroids from Franklin County, Florida, St. Teresa, A. infestans was rare. The erect parts of these plants corresponded very well with Hoyt's drawings and descriptions.

A. infestans was abundant on hydroids collected from Fort Macon, Beaufort, North Carolina; some of these hydroids were completely red because of the extensive growth of A. infestans. It was observed that the erect parts of these plants were often bushy and 0.3 mm. in height. Terminal hairs were rare in these erect plants. It is possible that these plants represent a variety of A. infestans. However, it appears that A. infestans is polymorphic. Further observations are necessary for establishing a new variety.

The author failed to locate A. infestans from the type specimen in the Herbarium of the Smithsonian Institution. The slides on the herbarium sheet of co-type material in the Duke University Herbarium are damaged and hardly anything can be distinguished.

Specimens examined: NORTH CAROLINA all on hydroids, Cape Lookout, Aziz, August 8, 1961 (DUKE); drifted ashore, Fort Macon, near Beaufort, Aziz and Shaio, January 29, 1964 (DUKE); FLORIDA on hydroids, St. Teresa, Franklin County, Humm, July 16, 1955 (DUKE).

ACROCHAETIUM ALCYONIDIAE Jao

Pl. XIII, Fig. 4

Acrochaetium alcyonidiae Jao, Bull. Torrey Bot. Club 63:237. 1936.

Plants epi-endozoic in the colonial bryozoan Alcyondium verrilli in most part endozoic with exserted short branches bearing monosporangia; erect filaments usually 100 to 600μ in height, larger in diameter than most of the endozoic filaments; endozoic filaments 5-13μ diam., mostly 5-6μ; asexual reproduction usually by monospores, rarely by bispores; sexual reproduction unknown.

This species was previously known only from Massachusetts. This record extends its distribution to Virginia.

This species resembles A. endozoicum (Darbishire) Hamel in having similar endophytic filaments but differs from it by the absence of forked branches in the erect part and larger monosporangia.

In August, 1962, an abundance of Alcyonidium verrilli washed ashore on the beach at New Point, Virginia, in the Chesapeake Bay. Alcyonidium verrilli normally appears grey but due to the abundant growth of Acrochaetium alcyonidiae, some parts, or all of the host became completely red. On microscopic examination of these red areas, it was found that the Acrochaetium filaments were densely packed in the host. Plectonema sp. and Anacystis sp., two blue green algae, were also present in small amounts in the host. A specimen of A. endozoicum (Collins, NY), growing in a Bryozoan, was examined for comparison.

Specimens examined: VIRGINIA, on Alcyonidium verrilli, washed ashore, Aziz, August 4, 1962 (DUKE); MASSACHUSETTS, on Alcyonidium mytili, Pine Island, Woods Hole, Taylor, July 9, 1938 (FH).

ACROCHAETIUM VIRGATULUM (Harvey) J. Agardh

Pl.XII, Fig. 3; Pl.XV, Fig. 4

Callithamnion virgatulum Harvey, in Hooker, Eng. Flora 349. 1833.

Chantransia virgatula (Harvey) Le Jolis, Mem. Soc. Sci. Nat. Cherb. 10:106. 1863.

Acrochaetium virgatulum (Harvey) Agardh, Lunds Univ. Arsskr. 28: 48. 1892.

Chromastrum virgatulum (Harvey) Papenfuss, Univ. Calif. Pub. Bot. 18:323. 1945.

Kylinia virgatula (Harvey) Papenfuss, Univ. Calif. Pub. Bot. 18: 437. 1947.

Plants epiphytic with a parenchymatous basal disc, from which one to many erect filaments arise, germinating first to a small parenchymatous disc and then to the erect filaments, erect part 2 mm. tall, sometimes only a few hundred microns, 7-14μ diam., 2-5 times as long as broad, unicellular terminal hairs usually present; monosporangia sparse to abundant, variously arranged, 10-18μ diam., 12-22μ long; tetrasporangia rare, and borne on the same plants with the monosporangia; sexual plants have not been reported.

Known from North Atlantic, Baltic, Mediterranean Sea and North Carolina; on Gracilaria foliifera, Agardhiella tenera, Rhodymenia palmetta, Codium tomentosum, Caulerpa, Acetabularia, Dictyota and Padina.

In the specimens examined by the author a large degree of variation seemed to be the rule. Differences are particularly evident in plants growing in different areas, especially between the cold and warm water areas. All stages of the germinating spore are particularly evident in the specimens from Montauk Point, Long Island; in these plants the developmental stages of the plant could easily be followed upto mature plants. The specimens from this area are excellent for observing germinating stages because the spores are

germinating on a very thick colorless Cladophora wall.

It was also observed in some of the specimens examined that the basal disc often gave rise to short creeping filaments at the margin.

Specimens examined: NORTH CAROLINA all in shallow water; in a wave beaten area, Fort Macon, near Beaufort, Aziz, June 27, 1960 (DUKE); on Gracilaria foliifera Fort Macon, Aziz, August 5, 1961 (DUKE); on hydroids, Cape Lookout, Aziz, August 8, 1961 (DUKE); on G. foliifera, Radio Island breakwater, near Beaufort, Aziz, August 14, 1963 (DUKE); on Leptogorgia virgatula (soft coral), on the inside skeleton where the animals have died off, Radio Island breakwater, Aziz, April 5, 1963 (DUKE); on Punctaria plantaginea, sea wall near the Fish and Wildlife Laboratory, Pivers Island, Beaufort, Aziz, April 6, 1963 (DUKE); on G. foliifera north of laboratory, Pivers Island, Hoyt, August 10, 1907, (DUKE); on Padina vickersiae, Shackleford breakwater, near Beaufort, Hoyt, August 12, 1907 (DUKE); NEW YORK on Polysiphonia urceolata, Rhodomela confervoides and Cladophora sp. Montauk Point, Long Island, Fiore, April 3, 1963 (DUKE); MASSACHUSETTS on Zostera, East Falmouth, Collins, July 1882 (US, as Trentepohlia virgatula); MAINE Portland, Farlow (US, as Chantransia virgatula); NOVA SCOTIA on Halosaccion ramentaceum, breakwater of Royal Nova

Scotia yacht squadron, Halifax harbor, deWitt and Bell, July 25, 1949 (DUKE); SWEDEN ad Tes Kebackskil in Bahusia, Wittrock, 18762 (FH as Chantransia secundata); FRANCE, Belle-Ile, Thuret, August 1851 (FH as Chantransia virgatula); GERMANY in mari emergens prope Krindbrunnen, insulae Helgoland, Kuckuck, June (US, as Chantransia virgatula).

ACROCHAETIUM THURETII (Rosenvinge) Collins & Hervey

Chantransia efflorescens var. thuretii Bornet, Bull. Soc. Bot. France XVI. 1904.

Chantransia thuretii (Bornet) Kylin, Stud. Algen. Schwed. Westk. 119. 1907.

Acrochaetium thuretii (Bornet) Collins & Hervey, Proc. Amer. Acad. Art and Sci. 53:97. 1917.

Plants epiphytic, holdfast composed of an epiphytic irregular disc, 120μ diam., erect part 3 mm. tall; main filaments 7.5-12.0μ diam.; monosporangia 9-11μ diam., 14-17μ long, borne on the abaxial surface of the lower one to three cells of the branches; usually on one-celled stalks; sexual plants monoecious; female plants usually bear clusters of carposporangia in similar locations as monosporangia; carposporangia 11-14μ diam., 18-21μ long; spermatia produced in a similar location as the carposporangia.

Previously known from North Atlantic, Channel Islands and Juan Fernandez Islands; on Dictyota and Splachnidium. This report extends the distribution of this species to North Carolina and Florida; on Gelidium crinale and Caulerpa prolifera.

ACROCHAETIUM LIAGORAE Børgesen

Pl.II, Figs. 19-21; Pl.XV, Fig. 2

Chantransia liagorae (by mistake) Børgesen Dansk. Bot. Ark. 3: 57. 1915.

Acrochaetium liagorae Børgesen Dansk. Bot. Ark. 3:58. 1915.

Acrochaetium collinsianum Børgesen Dansk. Bot. Ark. 3:454. 1920.

Chromastrum liagorae (Børgesen) Papenfuss Univ. Calif. Pub. Bot. 18:324. 1945.

Kylinia liagorae (Børgesen) Papenfuss, Univ. Calif. Pub. Bot. 18:438. 1947.

Plants endophytic in various species of Liagora, growing intermingled with the assimilatory filaments of the latter in the mucilage, cells irregular in shape, mostly swollen in the middle 8-16μ diam., to 35μ long, each cell with a single stellate chromatophore; monosporangia about 14μ broad, 20μ long.

Known from Virgin Islands and Florida on Liagora pennata. This report extends the distribution of this species to Alacran Reef, southern Gulf of Mexico, on Liagora mucosa.

Sexual reproduction has not been reported in this species. In the plants from Alacran Reef the author found sexual reproduction. Plants are monoecious, the carpogonia often occurring near a spermatangial cluster on the same branch. Spermatangia are about 3.5-5.0μ diam., 4-6μ long. Mature spermatia are almost spherical, 3.5-4.5μ diameter. Carpogonia are solitary usually about 40μ long, sometimes shorter, about 7μ broad at the base. The trichogynes are about 2.5μ diam., 27.0μ long. Carpospores are developed directly from the fertilized carpogonium, usually solitary, sometimes in pairs. Gonimoblast filaments are absent.

The length of the cells in the Alacran Reef plants is sometimes to 60μ and hairs are rare. The cells of A. liagorae has a high degree of resemblance to the cells of the assimilatory filaments of Liagora.

Specimens examined: SOUTHERN GULF OF MEXICO, in Liagora mucosa, in shallow water, around Isla Perez. Alacran Reef, Aziz and Humm, June 29, 1961 (DUKE); VIRGIN ISLANDS in L. ceranoides, in shallow water, Reef Bay, St. John, Welch, March 26, 1962 (DUKE).

ACROCHAETIUM ACANTHOPHORAE SP. NOV.

Pl. III, Figs. 12-13

Thallus endophyticus, filamentis ramosis atque alternia; cellulae plerumque 7-13μ crassae 18-40μ long; diametro, 4-5 plo longiores; filamentis monosporangiis subcorticalibus; monosporangia sphaerica 10-15μ diam. ad superficiem hospitis plerumque ex stipitibus unicellularibus gerentibus

Hab. in stratu corticali Acanthophorae spiciferae in "Doctors Cove" insulae "Jamaicae."

Plants endophytic, embedded in the polysaccharide walls of the host, filaments alternately branched; cells usually 7-13μ broad, 18-40μ long, mostly 4-5 times as long as broad; ends of the cells slightly less in diameter than the mid-part, rarely irregular in shape or cylindrical; each cell with a diffused stellate chromatophore and a single pyrenoid; filaments bearing the monosporangia spread just under the surface of the host; monosporangia usually borne on one celled stalks protruding just beyond the surface of the host, spherical, 10-11μ in diam.; sexual plants not observed.

This species most closely resembles A. liagorae in its habit, from which it can be differentiated by the smaller diameter of the monosporangia, by the production of the monosporangia outside the host surface and by the complete absence of any

hairs. In A. liagorae the monosporangia are 14μ in diameter and 20μ long and are produced endophytically. A. liagorae is known only as an endophyte in Liagora.

Type locality: Doctors Cove, Montego Bay, Jamaica.

Specimens examined: JAMAICA in Acanthophora spicifera, Doctors Cove, Montego Bay, Humm, May 22, 1962 (DUKE, TYPE); FLORIDA in A. spicifera, Biscayne Bay at Coconut Grove, Miami, Humm, January 9, 1946 (DUKE).

KYLINIA Rosenvinge

Family Acrochaetiaceae

Order Acrochaetiales

Class Florideae

Phyllum Rhodophyta

Plants minute (less than 85μ high), composed of either creeping or erect filaments, usually branched; cells uninucleate, with a parietal or stellate chromatophore, or several discoid chromatophores, with or without pyrenoids; unicellular hyaline hairs often present; asexual reproduction by lateral or terminal monosporangia; sexual plants monoecious or dioecious; spermatangia solitary, in pairs, or in clusters, produced by special androphore filaments; carpogonia solitary, lateral or terminal, carposporangia solitary or in groups.

Rosenvinge separated Kylinia from Acrochaetium based on the presence of androphores and the mode of development and structure of cystocarp in the former species.

KYLINIA BLOMQUISTII SP. NOV.

Pl.VI, Figs. 3-6; Pl.XIII, Figs. 1-4

Named after Late Dr. H.L. Blomquist, Professor Emeritus of Botany, Duke University, Durham, North Carolina. His combined interest and contributions in marine algae, vascular plants and mosses made him a unique person.

Thalli dimorphici; thalli masculinei cum chromatophora parva vel nil praeter cellulam primam compositi; thalli feminei cellularum latorum compositi; chromatophorum copisum; spora prima ad hospitem adhaerente, circa 15 x 5μ, unum filum vel bini fila erecta ferente; monosporangia in thallis ambis ferentes, laterales vel terminales, plerumque 6-7μ diam., 8-10μ long; pili unicellulares saepe in thallis ferentes; thalli masculinei usque 65μ alti plerumque multo minores; androphora ramosa vel non ramosa; cellulae androphori 2.5-3.5μ diam., 7-16μ long; spermatangia 3-6μ diam. vel atiquantum longiore; thalli feminei usque 80μ alti; cellulae filiorum primorum 5-8μ latae diametro 1.0-2.5 plo longiores; chromatophora discoidea, uninucleata, pyrenoide solitario; carpogonia ad basem 5-6μ diam. trichogyne breve, carpogonia atque monosporangia in amptitude similares, a latere aggragata; cystocarpum solitarium.

Hab. Beaufort, North Carolina in filis cresentebus arthrocladiae villosae.

Plants dimorphic, male plants usually reduced and composed of androphore cells containing a single small chromatophore or none at all; female plants composed of cells of larger diameter and with a more conspicuous chromatophore; original spore attached to the host, about 15μ long and 5μ wide, germinating spore usually giving rise to one or two erect filaments which branch at maturity, often bent towards the filaments of the host; monosporangia borne by both the male and female plants, usually 6-7μ diam., 8-10μ long, lateral or terminal; unicellular hairs often present in both male and female plants; male plants upto 65μ high, usually much smaller, androphores branched or unbranched; cells of the androphore 2.5-3.5μ diam., 7-16μ long; androphores irregularly branched, bearing lateral or terminal or both kinds of spermatangia usually in clusters, sometimes in pairs; spermatangia 3-6μ diam., as long as, or slightly longer than broad; original spore particularly conspicuous in the male plants; female plants upto 80μ in height; cells of the main filaments 5-8μ diam., 1.0-2.5 times as long as broad, with many discoid chromatophores and a single nucleus and usually a single pyrenoid; carpogonia 5-6μ diam., at the base, abruptly terminated in a short trichogyne; carposporangia of about the same dimensions as the monosporangia,

borne in lateral clusters, usually one cystocarp present per plant.

In the collection of Humm in May, 1964 from Beaufort, K. blomquistii is abundant on the assimilatory filaments of Arthrocladia villosa.

This species is distinguished from the three species of Kylinia described to date by its dimorphic nature and larger androphores. K. blomquistii is the only species in which the male plant is usually entirely composed of androphore(s), excepting the original spore, and in which the androphore is branched. In K. rosulata Rosenvinge, the androphore is unicellular, 1.0-1.5μ diam., 4-7μ long, spermatangia 1.5-2.5μ diam., 2-4μ long. K. rosulata is epiphytic, creeping on the assimilatory filaments of Sporochnus pedunculatus.

K. australis Levring is epiphytic on Acrochaetium villiforme. Levring (1953) did not mention the measurements of the androphores in this species, but from his drawings it appears that they were shorter than the ones described by Rosenvinge.

Lyle (1929) described K. scapae from Scapa Flow, epiphytic on Cladophora. She did not find any androphore but included the species in the genus Kylinia because of its prostrate nature and similarities with K. rosulata. It may be pointed out here that the plants of K. australis and

K. blomquistii are erect and the plants of K. rosulata and K. scapae are primarily prostrate.

The genus Kylinia Rosenvinge, based on the presence of androphores, has not been reported from the Americas before.

Type locality: Beaufort, North Carolina.

Specimen examined: NORTH CAROLINA on the assimilatory filaments of Arthrocladia villosa, in about 30-40 ft. depth, taken by trawl from the motor vessel Beveridge, about three miles offshore from Beaufort, Beaufort Inlet, Humm, May 2, 1964 (DUKE, TYPE); on the assimilatory filaments of A. villosa, Cape Lookout, Williams, April 29, 1947 (DUKE).

ACROCHAETIUM Nägeli

Species List
(World Flora)

1. **A. AFFINE** Howe and Hoyt

   Howe and Hoyt, 1916, p. 118, pl. 15

   Hoyt, 1920, p. 471, pl. 119

   De Toni, 1924, p. 41, as Chantransia affinis

   Taylor, 1960, p. 305

   Distribution: North Carolina

   On Spyridia, Dictyota and other hosts

2. **A. AGARDHIELLAE** Joly and Cordeiro

   Joly and Cordeiro, 1963, p. 137, pl. 2, Figs. 1-4

   Distribution: State of São Paulo (Brazil)

   On Agardhiella tenera

3. **A. ALARIAE** (Jonsson) Bornet

   Jonsson, 1901, p. 132, Fig. 1, as Chantransia alariae

   Børgesen, 1902, p. 356, as Chantransia alariae

   Bornet, 1904, p. xix

   Levring, 1937, p. 86, Fig. 1, as Chantransia alariae

   Taylor, 1937, p. 229

Kylin, 1944, p. 13, as Kylinia alariae

Papenfuss, 1945, p. 320, as Chromastrum alariae

Papenfuss, 1947, p. 436, as Kylinia alariae

Taylor, 1957, p. 213, as Kylinia alariae

Distribution: North Atlantic

On Alaria

4. A. ALCYONIDII Jao

Jao, 1936, p. 245, pl. 12, Figs. 2-5

Taylor, 1937, p. 234, pl. 34, Figs. 2-5

_____, 1957, p. 220, pl. 34, Figs. 2-5

Distribution: New England

On Alcyonidium

5. A. AMERICANUM Jao Papenfuss

Jao, 1936, p. 237, pl. 13, Fig. 8, as Colaconema americana

Taylor, 1937, p. 216, pl. 29, Fig. 8, as C. americana

Papenfuss, 1945, p. 312

Taylor, 1957, p. 216, pl. 29, Fig. 8, as C. americana

Distribution: New England

On Asparogopsis hamifera

6. A. AMPHIROAE (Drew) Papenfuss

Drew, 1928, p. 179, pl. 40, Figs. 34-37

Papenfuss, 1945, p. 312

Taylor, 1957, p. 223

Distribution: California

On Amphiroa

7. **A. ANGUSTUM** (Drew) Papenfuss

Drew, 1928, p. 185, pl. 44, Figs. 54-56

Papenfuss, 1945, p. 312

Distribution: Pacific Coast of North America

In Liagora

8. **A. ANTILLARUM** Taylor

Taylor, 1942, p. 78, pl. 2, Figs. 3-4

_____, 1960, p. 311

Distribution: West Indies

On Bryopsis

9. **A. ARCUATUM** (Drew) Tseng

Drew, 1928, p. 165, pl. 37, Figs. 1-3, as Rhodochorton arcuatum

Kylin, 1944, p. 13, as Kylinia arcuata

Tseng, 1945, p. 158, pl. 1, Fig. 1

Papenfuss, 1945, p. 321, as Chromastrum arcuatum

_____, 1947, p. 436, as Kylinia arcuata

Distribution: Pacific Coast of North America, Hong Kong

On Pterosiphonia bipinnata, Pterosiphonia woodii, Polysiphonia, Sphacelaria, and Chaetomorpha

10. **A. ARMORICANUM** Feldmann

Feldmann, 1954

Distribution: Roscoff (France)

11. **A. ARNOLDII** Weber-van Bosse

Weber-van Bosse, 1921, p. 194, Figs. 54-55

De Toni, 1924, p. 67, as Chantransia arnoldii

Distribution: East Indies

On Roschera

12. **A. ASCIDIOPHILUM** Dawson

Dawson, 1952, p. 21, pl. 10, Figs. 5-6

Distribution: Baja California (Mexico)

13. **A. ASPAROGOPSIS** (Chemin) Papenfuss

Chemin, 1926, p. 902, Figs. 1-4, as Colaconema asparogopsis

Papenfuss, 1945, p. 312

Distribution: Atlantic Coast of France

On Asparogopsis

14. **A. ATTENUATUM** (Rosenvinge) Hamel

Rosenvinge, 1909, p. 106, Fig. 35, as Chantransia attenuata

Hamel, 1927, p. 99

Jao, 1936, p. 244, pl. 12, Fig. 1

Taylor, 1937, p. 236, pl. 34, Fig. 1

_____, 1957, p. 222, pl. 34, Fig. 1

Distribution: North Atlantic

On Polysiphonia and Desmarestia

15. A. AVRAINVILLEAE Børgesen

Børgesen, 1915, p. 48, Figs. 47-49

De Toni, 1924, p. 52, as Chantransia avrainvilleae

Phillips and Springer, 1960, p. 370

Taylor, 1960, p. 311

Distribution: Virgin Islands and Florida

On Avrainvillea

16. A. BAHREINII Børgesen

Børgesen, 1939, p. 102, Fig. 26

Distribution: Iranian Gulf

On Dictyota

17. A. BALTICUM (Rosenvinge) Nov. comb.

Rosenvinge, 1909, p. 97, Fig. 27, as Chantransia baltica

Levring, 1937, p. 321, as Chromastrum balticum

_____, 1947, p. 436, as Kylinia baltica

Distribution: Baltic Sea, West coast of Norway

On Polysiphonia, and Ceramium

18. A. BARBADENSE (Vickers) Børgesen

Crouan, in Maze et Schramm, 1870-1877, p. 143, no. 1384

as Callithramnion pedunculatum

Bornet, 1904, p. 20, as Chantransia barbadensis

Vickers, 1905, p. 60, as Chantransia barbadensis

Børgesen, 1915, p. 45

Hamel, 1927, p. 70, Fig. 41

Taylor, 1931, p. 299

Distribution: West Indies and Bermuda

On Liagora

19. A. BATTERSIANUM Hamel

Batters, 1896, p. 9, as Chantransia microscopica

Kuckuck, 1897, p. 392, as Chantransia microscopica

Hamel, 1927, p. 83

Newton, 1931, p. 253

Distribution: England

On Porphyra

20. A. BISPORUM (Børgesen) Børgesen

Børgesen, 1910, p. 178, Fig. 1, as Chantransia bispora

Børgesen, 1915, p. 43, Fig. 41

De Toni, 1924, p. 49, as Chantransia bispora

Taylor, 1960, p. 312

Distribution: Virgin Islands

On Acanthophora

21. A. BONNEMAISONIAE (Batters) J. et G. Feldemann

Batters, 1896, p. 8, as Colaconema bonnemaisoniae

Chemin, 1926, p. 182, Figs. 1-3, as C. bonnemaisoniae

Levring, 1937, p. 94, Fig. 6 a-c, as Chantransia bonnemaisoniae

Newton, 1937, p. 250, Fig. 154, as C. bonnemaisoniae

Feldmann, J. and G., 1939, p. 458

Dixon, 1961, p. 75

Distribution: England, West coast of Norway, Atlantic coast of France, North Africa, and Channel Islands

On Bonnemaisonia asparogoides and B. clavata

22. A. BORGESENII Schiffner

Schiffner, 1931, p. 143, Fig. 1

Papenfuss, 1945, p. 322, as Chromastrum borgesenii

_____, 1947, p. 437, as Kylinia borgesenii

Distribution: Adriatic Sea

On Chaetomorpha

23. A. BORNETII Papenfuss

Thuret, in Le Jolis 1863, p. 107 (in part)

Bornet and Thuret, 1876, p. 16, pl. 5, as Chantransia corymbifera Thuret

Batters, 1902, p. 59, as Acrochaetium corymbiferum

Bornet, 1904, p. xx, as Chantransia corymbifera

Hoyt, 1920, p. 473, as A. corymbiferum

Hamel, 1927, p. 27, Fig. 25, as A. corymbiferum

Drew, 1928, p. 183, as Rhodochorton corymbiferum

Kylin, 1930, p. 5, Fig. 1, as Chantransia corymbifera

Newton, 1931, p. 255, Fig. 155, as Acrochaetium corymbiferum

Papenfuss, 1945, p. 313

Distribution: Northeastern Atlantic, Bermuda, North Carolina, California

On Helminthocladia, Thuretella, Dudresnaya and Dasya

24. A. BOTRYOCARPUM (Harvey) Agardh

Harvey, 1855, p. 563, as Callithamnion botryocarpum

_____, 1863, p. iv, no. 710, as C. botryocarpum

Agardh, 1892, p. 45

De Toni, 1897, p. 72, as Chantransia botryocarpa

Bornet, 1904, p. xxl, as Chantransia botryocarpa

Hamel, 1927, p. 71, Fig. 42

Distribution: Western Australia

On Scytosiphon

25. A BREBNERI (Batters) Hamel

Batters, 1897, p. 437, as Rhdochorton brebneri

Batters, 1900, tab. 414, Fig. 17, as R. brebneri

Rosenvinge, 1909, p. 82, in note as Chantransia brebneri

Hamel, 1927, p. 91

Distribution: Plymouth (England)

On Gloeosiphonia

26. **A. BULBOSUM** Hamel

Hamel, 1927, p. 76, Fig. 45

Distribution: Chili

On species of Ceramiaceae

27. **A. CAESAREAE** Feldmann

Feldmann, 1931, p. 223, Fig. 5

Distribution: Mediterranean

On Porphyra

28. **A. CAESPITIFORME** Børgesen

Børgesen, 1920, p. 446, Fig. 416

De Toni, 1924, p. 49, as Chantransia caespitiformis

Taylor, 1960, p. 306

Distribution: Virgin Islands

On Padina

29. **A. CAESPITOSUM** (Agardh) Nägeli

Agardh, 1851, p. 18, as Callithamnion caespitosum

Nägeli, 1861, p. 171

Bornet, 1904, p. xx, as Callithamnion codii

Batters, 1896a, p. 9, as Chantransia caespitosa

Hamel, 1927, p. 42, Fig. 33

Dixon, 1961, p. 75

Distribution: Atlantic coast of France, Channel Islands

On Patella

30. **A. CANARIENSE** Børgesen

Børgesen, 1927, p. 17, Figs. 9-11

Distribution: Canary Islands

On Gelidium

31. **A. CANDELABRUM** Børgesen

Børgesen, 1942, p. 8, Fig. 1

Distribution: Mauritius, (Tamarin Bay)

On Sphacilaria furcigera

32. **A. CATENULATUM** Howe

Howe, 1914, p. 84, pl. 31, Figs. 12-18

Børgesen, 1915, p. 22

Kylin und Skottsberg, 1919, p. 3, Fig. 1

De Toni, 1924, p. 44, as Chantransia catenulata

Nakamura, 1941, p. 273, Fig. 1, as Rhodochorton catenulatum

Distribution: Tierra del Fuego, Peru, East Indies, Japan

On Ceramium, Chaetomorpha, Chondria, Sphacelaria

33. **A. CHAMPII** Anand

Anand, 1943, p. 8, Fig. 2B, a-b

Distribution: Karachi (Pakistan)

On Champia plumosa

34. **A. CHEMINII** Feldmann

Feldmann, 1954

Distribution: Roscoff (France)

35. **A. CHNOOSPORAE** Børgesen

Børgesen, 1942, p. 13-15, Fig. 5

Distribution: Mauritius (Tamarin Bay)

On Chnoospora implexa

36. **A. CHYLOCLADIAE** (Batters) Batters

Batters, 1896, p. 8, as Colaconema chylocladiae

Batters, 1902, p. 58

Van Heurck, 1908, p. 49, as Chantransia chylocladiae

De Toni, 1924, p. 57, as Chantransia chylocladiae

Miranda, 1932, p. 277, Fig. 2

Distribution: England, France

On Gastroclonium

37. **A. CLANDESTINUM** (Montagne) Howe

Montagne, 1837, p. 350, as Callithamnion clandestinum

_____, 1839, p. 15, Tab. VII, Fig. 2, as Callithamnion clandestinum

Kützing, 1849, p. 642, as Callithamnion clandestinum

Agardh, 1851, p. 63, as Callithamnion clandestinum

Howe, 1914, p. 86, pl. 31, Figs. 19-24

De Toni, 1924, p. 54, as Chantransia clandestina

Distribution: Peru

On Chaetomorpha and Cladophora

38. **A. COCCINEUM** (Drew) Papenfuss

Drew, 1928, p. 192, pl. 47, Fig. 82, pl. 48, Figs. 83-86

Papenfuss, 1945, p. 313

Distribution: California

On Laminaria

39. **A. CODICOLA** Børgesen

Børgesen, 1927, p. 33, Figs. 18-20

Distribution: Canary Islands

On Codium

40. **A. CODII** (Crouan) Bornet

Crouan, 1860, p. 135, as Callithamnion codii

Bornet, 1904, p. 20

Hamel, 1927, p. 30, Fig. 3-7

Levring, 1937, p. 89, Fig. 13

Distribution: Eastern North Atlantic

On Codium

41. **A. COLLOPODUM** (Rosenvinge) Hamel

Rosenvinge, 1898, p. 41, Fig. 10-11, as Chantransia microscopica var. collopoda

Rosenvinge, 1909, p. 81, as C. collopoda

De Toni, 1924, p. 43, as Chantransia marina var. collopoda

Hamel, 1927, p. 81

Levring, 1935, p. 34, Fig. 5 e-m, as C. collopoda

Papenfuss, 1945, p. 321, as Chromastrum collopodum

_____, 1947, p. 435, as Kylinia collopoda

Kylin, 1944, p. 15, Kylinia collopoda

Distribution: Greenland, West Coast of Norway, and West Coast of Sweden

On Chondria and Laminaria

42. A. COMPACTUM Jao

Jao, 1936, p. 241, pl. 10, Figs. 6-14

Papenfuss, 1945, p. 321, as Chromastrum compactum

_____, 1947, p. 436, as Kylinia compacta

Williams, 1948, p. 690

Taylor, 1937, p. 228, pl. 32, Figs. 6-14

_____, 1957, p. 212, pl. 32, Figs. 6-14, as Kylinia compacta

Distribution: Near Fairhaven, New Bedford, Massachusetts, North Carolina

On Cladophora and Chaetomorpha brachygona

43. A. COMPTUM Børgesen

Børgesen, 1915, p. 46, Figs. 44-46

Williams and Blomquist, 1947, p. 392

De Toni, 1924, p. 40, as Chantransia compta

Taylor, 1960, p. 312

Distribution: Virgin Islands, Brazil

On Liagora

44. **A. CRASSIPES** (Børgesen) Børgesen

Børgesen, 1909, p. 1, Fig. 1, as Chantransia crassipes

_____, 1915, p. 20, Fig. 11-13

Howe, 1918, p. 511

Taylor, 1928, p. 134, pl. 2, Fig. 16

Hamel, 1927, p. 81

Collins et Harvey, 1917, p. 96

Børgesen, 1924, p. 25

Papenfuss, 1945, p. 321, as Chromastrum crassipes

_____, 1947, p. 436, as Kylinia crassipes

Kylin, 1944, p. 13, as Kylinia crassipes

Humm and Caylor, 1957, p. 250, pl. 7, Fig. 8

Taylor, 1941, p. 75

Phillips, 1960, p. 241

Taylor, 1960, p. 300, as Kylinia crassipes

Humm, 1962, p. 250, as Kylinia crassipes

Distribution: Bermuda, Florida, Texas, Hispaniola, Virgin Islands, Canary Islands, India, and Vera Cruz (Mexico)

On Centroceras, Hypnea, Polysiphonia subtilissima

45. **A. CURTUM** Baardseth

Baardseth, 1941, p. 40, Fig. 16 E-H

Papenfuss, 1947, p. 436, as Kylinia curta

Distribution: Tristan da Cunha

On Polysiphonia

46. **A. CYMOPOLIAE** Børgesen

Børgesen, 1927, p. 22, Fig. 12

Distribution: Canary Islands

On Cymopolia

47. **A CYTOPHAGUM** (Rosenvinge) Hamel

Rosenvinge, 1909, p. 121, Figs. 50-51, as Chantransia cytophaga

Levring, 1935, p. 39, as Chantransia cytophaga

Hamel, 1927, p. 91

Papenfuss, 1945, p. 324, as Chromastrum cytophagum

_____, 1947, p. 438, as Kylinia cytophaga

Distribution: Denmark and West Coast of Sweden

On Porphyra

48. **A. DASYAE** Collins

Collins, 1906, p. 191

Collins, 1911, p. 186, as Chantransia dasyae

Hamel, 1927, p. 77, Fig. b-g

Taylor, 1937, p. 231

_____, 1957, p. 217

Distribution: New England

On Dasya

49. **A. DAVIESII** (Dillwyn) Nägeli

Dillwyn, 1809, p. 73, as Conferva daviesii

Kützing, 1849, p. 639, as Callithamnion mirabile

Harvey, 1851, pl. 314, as Callithamnion daviesii

Nägeli, 1861, p. 405, Figs. 26-27

Thuret, 1863, p. 103, as Chantransia daviesii

Rosenvinge, 1909, p. 184, Fig. 34, as Chantransia daviesii

Hamel, 1927, p. 39, Fig. 31

Børgesen, 1927, p. 25, Fig. 15

Funk, 1955, p. 61

Taylor, 1937, p. 234, pl. 31, Figs. 8-10

_____, 1957, p. 221, pl. 31

_____, 1960, p. 307

Distribution: North Atlantic, Mediterranean, California, Revilla-gigedo Islands, Stuart Islands (New Zealand), Tristan da cunha, Inaccessable Island

On Cystoseira, Caulerpa, Griffithsia, Cladophora

50. **A. DELISEAE** nom nov.

Levring, 1953, p. 472, Fig. 9, as A. unifilum nomum nudum (not A. unifilum Jao)

Distribution: Kangaroo Island, Australia

On Delisea hypneoides

51. **A. DENSUM** (Drew) Papenfuss

Drew, 1928, p. 168, pl. 38, Figs. 17-24, as Rhodochorton densum

Papenfuss, 1945, p. 308

Distribution: California

On Spongomorpha

52. A. DESMARESTIAE Kylin

Kylin, 1925, p. 10, Fig. 4 a-f

Drew, 1928, p. 168, pl. 28, Fig. 16, as Rhodochorton desmarestiae

Doty, 1947, p. 162

Distribution: Friday Harbor (Washington), Cape Perpetua and Coos Bay (Oregon)

On Desmarestia

53. A. DICTYOTAE Collins

Collins, 1906, p. 193

_____, 1911, p. 197, as Chantransia dictyotae

Drew, 1928, p. 190, pl. 47, Figs. 79-80, as Rhodochorton dictyotae

Distribution: California

On Dictyota

54. A. DISCOIDEUM Børgesen

Børgesen, 1920, p. 271, Fig. 17 b-d

De Toni, 1924, p. 711, as Chantransia discoidea

Distribution: Easter Island

On Sargassum

55. **A. DREWIAE** Baardseth

Baardseth, 1941, p. 43, Fig. 19 a-d

Papenfuss, 1947, p. 436

Distribution: Nightingale Island

On Laminaria

56. **A. DUBOSCQII** J. Feldmann

Feldmann, 1939, p. 261, Fig. 6

Papenfuss, 1945, p. 322, as Chromastrum duboscqii

_____, 1947, p. 437, as Kylinia duboscqii

Distribution: France (Banyuls, Ile Grosse, cap du Troc); Mediterranean; usually on Bryopsis mucosa, rarely on Chaetomorpha capillaris

57. **A. DUFOURII** (Collins) Børgesen

Collins, 1909, no. 1594

_____, 1911, p. 187, as Chantransia dufourii

Børgesen, 1915, p. 19

Collins and Hervey, 1917, p. 6

Hoyt, 1920, p. 470, Fig. 26

Taylor, 1960, p. 305

Distribution: North Carolina, Bermuda

On Sargassum, on Dictyota

58. **A. DUMONTIAE** (Rosenvinge) Hamel

Rosenvinge, 1909, p. 124, Fig. 52, as Chantransia dumontiae

Hamel, 1927, p. 91

Papenfuss, 1945, p. 324, as Chromastrum dumontiae

_____, 1947, p. 438, as Kylinia dumontiae

Distribution: Denmark

On Dumontia

59. **A. DWARKENSE** Børgesen

Børgesen, 1932, p. 114, Fig. 1

Distribution: India

On Dictyotaceae

60. **A. EASTWOODAE** (Setchell and Gardner) Papenfuss

Papenfuss, 1945, p. 306

Setchell and Gardner, 1930, p. 166, pl.4, Figs. 8, as Rhodochorton eastwoodae

Distribution: Revilla-gigedo Islands

On Dictyota

61. **A. EFFUSUM** Levring

Levring, 1953, p. 479, Fig. 13 F-G

Distribution: Australia, (Moreton Bay, Moreton Island)

On hydrozoans

62. **A. ELEGANS** (Drew) Papenfuss

Drew, 1928, p. 181, pl. 41, Fig. 41, pl. 43, Fig. 46

Papenfuss, 1945, p. 314

Distribution: California

On Eisenia

63. A. EMERGENS (Rosenvinge) Weber-Van Bosse

Rosenvinge, 1909, p. 128, Fig. 55

Weber-Van Bosse, 1921, p. 194

Hamel, 1927, p. 93

Taylor, 1937, p. 235

Levring, 1937, p. 91, Fig. 14, as Chantransia emergens

Taylor, 1957, p. 221

Distribution: North Atlantic

On Polysiphonia

64. A. ENDOPHYTICUM Batters

Batters, 1896b, p. 386

Kylin, 1907, p. 188, as Rhodochorton endophyticum

Baardseth, 1941, p. 45, Fig. 19 E-G

Papenfuss, 1947, p. 436

Distribution: England, Tristan da Cunha

On Heterosiphonia

65. A. ENDOZOICUM (Darbishire) Batters

Darbishire, 1899, p. 15, tab. 1, as Chantransia endozoica

Batters, 1902, p. 58

Rosenvinge, 1909, p. 128

Howe and Hoyt, 1916, p. 117

Hamel, 1927, p. 32

Levring, 1937, p. 91, as Chantransia endozoica

Knight and Parke, 1931, p. 78, 114, pl. 13, Figs. 34, 40

Distribution: Northeastern Atlantic

On Alcyonidium

66. A. EPISCULUM Joly and Cordeiro

Joly and Cordeiro, 1963, p. 135, pl. 1, Figs. 1-4

Distribution: São Paulo (Brazil)

On Zygomycale parishii (sponge)

67. A. ERECTUM Børgesen

Børgesen, 1932, p. 114, Fig. 1

Distribution: India

On Agardhiella

68. A. ERNOTHRIX Børgesen

Børgesen, 1915, p. 59, Figs. 63-64

Taylor, 1960, p. 316

Distribution: Virgin Islands

On Centroceras

69. A. ERYTHROPHYLLUM Jao

Jao, C.C., 1937, p. 112, pl. 14, Figs. 1-3

Papenfuss, 1947, p. 436

Distribution: Pacific coast of North America, near Port Angeles, Washington

70. **A. EXTENSUM** Ercegovic

Ercegovic, 1957, p. 68, Fig. 21 a-d

Distribution: Yugoslavia

On Chylocladia kaliformis and Laurencia obtusa

71. **A. FERNANDEZIANUM** (Levring) Papenfuss

Levring, 1941, p. 631, Fig. 10, I-R, as Chantransia fernandeziana

Papenfuss, 1947, p.436

Distribution: Juan Fernandez Islands

On Dictyota

72. **A. FLEXUOSUM** Vickers

Bornet, 1904, p. XXI

Vickers, 1905, p. 60

Collins, 1909, p. 192

Collins, 1911, p. 186, as Chantransia flexuosa

Børgesen, 1915, p. 34, Fig. 29-30

De Toni, 1924, p. 50, as Chantransia flexuosa

Hamel, 1927, p. 77, Fig. 47a

Taylor, 1937, p. 233

Taylor, 1957, p. 219

Joly, 1957, p. 96, pl. 12, Fig. 9

Humm and Darnell, 1959, p. 272

Taylor, 1960, p. 308

Phillips, R.C., 1960a, p. 241

_____, 1960b, p. 333

Phillips and Springer, 1960, p. 370

Humm, 1962, p. 250

Diaz-Piferrer, 1962, p. 244

Distribution: Virgin Islands, Barbados, New England (New Jersey, Rhode Island, and Southern Massachusetts), Florida, Texas, Chandeleur Island (Mississippi sound); East Indies, Puerto Rico

On Caulerpa paspaloidas, Sargassum, Halophila, Laurencia intricata, Cladophora fascicularis

73. A. FUEGIENSE Kylin

Kylin and Skottsberg, 1919, p. 5, Fig. 3

De Toni, 1924, p. 47, as Chantransia fuegensis

Distribution: Tierra del Fuego and Falkland Islands

On Ceramium

74. A. GLOBOSUM Børgesen

Børgesen, 1915, p. 28, pp. 21-22

De Toni, 1924, p. 53, as Chantransia globosa

Taylor, 1960, p. 308

Distribution: Virgin Islands

On Chaetomorpha

75. **A. GRACILE** Børgesen

Børgesen, 1915, p. 26, Figs. 19-20

De Toni, 1924, p. 54, as Chantransia gracilis

Børgesen, 1927, pp. 23-25, Fig. 14 a-c

Taylor, 1960, p. 307

Distribution: Virgin Islands, Canary Islands

On Sargassum, Gelidium

76. **A. GRANDIS** (Levring) Papenfuss

Levring, 1941, p. 632, Fig. 10 A-H, as Chantransia grandis

Papenfuss, 1947, p. 436

Distribution: Juan Fernandez Island

77. **A. GRATELOPUIAE** Dawson

Dawson, 1950, p. 153, Figs. 22-23

Distribution: Sonora, Mexico

On Grateloupia hancockii

78. **A. GYMNOGONGRI** (Drew) Papenfuss

Setchell and Gardner, 1917, P.B.A., fasc. 45, No. 2244

Drew, 1928, p. 175, pl. 40, Fig. 32, as Rhodochorton gymnogongri

Papenfuss, 1945, p. 318

Distribution: California

On Gymnogongrus

79. **A. GYNANDRUM** (Rosenvinge) Hamel

Crouan, 1867, p. 134, as Callithamnion minutissimum

Rosenvinge, 1909, p. 88, Fig. 18, as Chantransia gynandra

Hamel, 1927, p. 13, Fig. 15

Distribution: Denmark and Atlantic Coast of France

On Ectocarpus

80. **A. HALLANDICUM** (Kylin) Hamel

Kylin, 1906, p. 123, Fig. 8-9, as Chantransia hallandica

Rosenvinge, 1909, p. 93, Figs. 21-26, as C. hallandica

Hamel, 1927, p. 20-23, Fig. 19

Taylor, 1937, p. 229

Levring, 1940, p. 76, Fig. 22 c-d, as C. hallandica

Kylin, 1944, p. 15, as Kylinia hallandica

Papenfuss, 1945, p. 321, as Chromastrum hallandicum

Papenfuss, 1947, p. 436

Taylor, 1957, p. 213, as Kylinia hallandica

Distribution: North Atlantic and Baltic, Quiberon (France)

On Spongomorpha, Porphyra umbilicalis

81. **A. HAMELI** Feldmann

Feldmann, 1931, p. 224, pl. 11

Distribution: Mediterranean

On Porphyra

82. **A. HANCOCKII (Dawson) Papenfuss**

Dawson, 1944, p. 255, pl. 41, Figs. 4-6, as Rhodochorton hancockii

Papenfuss, 1945, p. 306

Distribution: Gulf of California

On Gelidium

83. **A. HIRSUTUM (Drew) N. Comb**

Drew, 1928, p. 166, pl. 37, Figs. 12-14, as Rhodochorton hirsutum

Kylin, 1944, p. 13, as Kylinia hirsuta

Papenfuss, 1945, p. 321, as Chromastrum hirsutum

_____, 1947, p. 436, as Kylinia hirsuta

Distribution: Pacific Coast of North America

On Polysiphonia

84. **A. HORMORHIZUM Børgesen**

Børgesen, 1915, p. 50, Figs. 50-52

De Toni, 1924, p. 65, as Chantransia hormorhiza

Taylor, 1960, p. 313

Distribution: Virgin Islands

On Champia

85. **A. HOWEI (Yamada) Papenfuss**

Yamada, 1932, p. 114, Fig. 3 a-d, as Rhodochorton affine

Yamada, 1938, p. 127, as Rhodochorton howeii

Papenfuss, 1945, p. 314

Distribution: Japan

On Codium

86. A. HOYTII Collins

Collins, 1908, p. 134

Collins, 1911, p. 186, as Chantransia hoytii

Børgesen, 1915, p. 58

Hoyt, 1920, p. 470, Figs. 27-28

Williams, 1948, p. 690

Taylor, 1960, p. 306

Humm, 1962, p. 250

Distribution: North Carolina, Texas, and Mexico

On Dictyota

87. A. HUMILE (Rosenvinge) Børgesen

Rosenvinge, 1909, p. 117, Figs. 44-45, as Chantransia humilis

Børgesen, 1915, p. 23

Levring, 1937, p. 89, as Chantransia humilis

_____, 1940, p. 78, Fig. 23 a-b

Papenfuss, 1945, p.323, as Chromastrum humile

Papenfuss, 1947, p. 437, as Kylinia humilis

Distribution: Denmark, Baltic, west coasts of Sweden and Norway

88. **A. HYALOSIPHONIAE** (Nakamura) Papenfuss

Nakamura, 1941, p. 287, Figs. 14-16, as Rhodochorton hyalosiphoniae

Papenfuss, 1945, p. 314

Distribution: Japan

On Hyalosiphonia

89 **A. HYPNEAE** (Børgesen) Børgesen

Børgesen, 1909, p. 2, as Chantransia hypneae

_____, 1915, p. 51, Figs. 53-54

Collins and Harvey, 1917, p. 98

Taylor, 1960, p. 313

Distribution: Virgin Islands and Bermuda

On Hypnea and Centroceras

90. **A. IMMERSUM** (Rosenvinge) Hamel

Rosenvinge, 1909, p. 130, Figs. 56-58, as Chantransia immersa

Hamel, 1927, p. 93

Levring, 1935, p. 459, Fig. 2, as Chantransia immersa

Papenfuss, 1945, p. 324, as Chromastrum immersum

Papenfuss, 1947, p. 438, as Kylinia immersa

Distribution: Denmark, West Coast of Sweden

On Rhodomela and Polysiphonia

91. **A. IMPLICATUM** (Drew) N. Comb.

Drew, 1928, p. 190, pl. 46, Figs. 76-78, as Rhodochorton implicatum

Papenfuss, 1945, p. 324, as Chromastrum implicatum

_____, 1947, p. 438, as Kylinia implicata

Distribution: California

On Halosaccion

92. **A. INCLUSUM** (Levring) Papenfuss

Levring, 1937, p. 96, Fig. 16 d-e, Chantransia inclusa

Papenfuss, 1945, p. 315

Distribution: West coast of Norway

On Dumontia

93. **A. INCRASSATUM** Ercegovic

Ercegovic, 1957

Distribution: Yugoslavia

94. **A. INFESTANS** Howe and Hoyt

Howe and Hoyt, 1916, p. 116, pl. 14

Hoyt, 1920, p. 473, pl. CXVIII

Hamel, 1927, p. 94

Papenfuss, 1945, p. 324, as Chromastrum infestans

_____, 1947, p. 438, as Kylinia infestans

Taylor, 1960, p. 301, as K. infestans

Humm, 1963, p. 521, as K. infestans

Distribution: North Carolina, North Africa, Bermuda, and

Florida

On Hydroids, Bryozoan and Zoobotryon

95. **A.** INTERMEDIUM Jao

Jao, 1936, p. 242, pl. II, Figs. 1-4

Taylor, 1937, p. 321, pl. 33, Figs. 1-4

_____, 1957, p. 218, pl. 33, Figs. 1-4

Distribution: New England

On Dasya

96. **A.** INTERPOSITUM (Heydrich) Børgesen

Heydrich, 1893, p. 78, pl. 22, Fig. 8, as Chantransia interposita

Børgesen, 1915, p. 57

Hamel, 1927, p. 93

Distribution: Bay of Islands, New Zealand

On Codium

97. **A.** IYENGARII Børgesen

Børgesen, 1933, p. 113, Fig. 1

Distribution: India

On Chaetomorpha

98. **A.** JAPONICUM Papenfuss

Inagaki, 1935, p. 44, Fig. 2, as Colaconema simplex

Papenfuss, 1945, p. 315

Distribution: Japan

On Asparagopsis

99. **A.** JONSSONII Papenfuss

Jonsson, 1901, p. 147, Fig. 4, as Rhodochorton repens

Papenfuss, 1945, p. 309

Distribution: Iceland

On Alaria

100. **A.** KRUSADII Børgesen

Børgesen, 1937, p. 32, Figs. 17-19

Distribution: Southern India

On Dictyota

101. **A.** KUCKUCKIANUM Hamel

Kuckuck, 1897, p. 391, Fig. 15, as Chantransia microscopica

Bornet, 1904, p. XX, as Chantransia microscopica

De Toni, 1924, p. 44, as Chantransia marina

Hamel, 1927, p. 86

Distribution: Helgoland

On Porphyra

102. **A.** KURILENSE (Nagai) Papenfuss

Nagai, 1941, p. 156, pl. 4, Figs. 23-28

Papenfuss, 1947, p. 435

Distribution: Kurile Islands

On Chaetomorpha

103. **A. KYLINII** Hamel

Kylin, 1907, p. 188, Fig. 40, as Rhodochorton endophyticum

Rosenvinge, 1923, p. 388, as Acrochaetium endophyticum

Hamel, 1927, p. 93

Distribution: West coast of Sweden

On Delesseria

104. **A. KYLINOIDES** Feldmann

Feldmann, 1958, p. 498, Fig. 3

105. **A. LAMINARIAE** Feldmann

Feldmann, 1954

Distribution: Roscoff (France)

106. **A. LAUTERBACHII** (Schmitz et Heydrich) Hamel

Heydrich, 1892, p. 475, as Chantransia mirabilis

Schmitz et Heydrich, 1900, p. 25, as Chantransia Lauterbachii

Hamel, 1927, p. 102

Distribution: New Guinea

On Sargassum

107. **A. LENORMANDI** (Suhr) Nägeli

Suhr in Kützing, 1849, p. 640, as Callithamnion lenormandi

Kützing, 1861, tab. XI, p. 57

Nägeli, 1861, p. 171

Hamel, 1927, p. 44, Fig. 34

Distribution: Cherbourg (France)

On Chaetomorpha

108. **A. LEPTONEMA** (Rosenvinge) Børgesen

Rosenvinge, 1909, p. 118, Figs. 46-48, as Chantransia leptonema

Børgesen, 1915, p. 31

Collins and Harvey, 1917, p. 97

Hamel, 1927, p. 35, Fig. 29

Taylor, 1928, p. 134

Levring, 1935, p. 38, Fig. 7 a-e

_____, 1940, p. 80, Fig. 23 c-f

Taylor, 1960, p. 308

Distribution: North Sea and Baltic, Mediterranean, Bermuda, Dry Tortugas, Posidonia

On Dictyopteris

109. **A. LEPTONEMOIDES** Levring

Levring, 1955, p. 416, Fig. 4

Distribution: New Zealand

110. **A. LEVRINGII** Papenfuss

Levring, 1945, p. 12, Fig. 4, as Acrochaetium microfilum

Papenfuss, 1947, p. 436

Distribution: Tierra del Fuego (Staten Island)

On *Desmarestia*

111. **A. LIAGORAE** Børgesen

Børgesen, 1915, p. 58, Figs. 60-62, *Chantransia liagorae*

_____, 1920, p. 454, as *Acrochaetium collinsianum*

Taylor, 1928, p. 134, pl. 20, Fig. 6

Papenfuss, 1945, p. 324, as *Chromastrum liagorae*

_____, 1947, p. 438, as *Kylinia liagorae*

Taylor, 1960, p. 301, as *Kylinia liagorae*

Distribution: Virgin Islands, Florida

In *Liagora pinnata*

112. **A. LIAGORAEFILUM** Børgesen

Børgesen, 1937, p. 35, Figs. 20-21

Distribution: India

In *Liagora*

113. **A. LIAGOROIDES** Børgesen

Børgesen, 1937, p. 40, Figs. 24-25

Papenfuss, 1945, p. 325, as *Chromastrum liagoroides*

_____, 1947, p. 438, as *Kylinia liagoroides*

Distribution: Southern India

In *Liagora*

114. **A. LORRAIN-SMITHIAE** (Lyle) Newton

Lyle, 1920, p. 13, Fig. 1, as *Chantransia lorrain-smithiae*

Newton, 1931, p. 256

Distribution: England

On Saccorhiza

115. A. MACOUNII (Collins) Hamel

Collins, 1913, p. 113, as Chantransia macounii

Hamel, 1927, p. 90

Drew, 1928, p. 184, pl. 43, Figs. 47-52; pl. 44, Fig. 53, as Rhodochorton macounii

Distribution: Pacific coast of North America

On Haploqloia

116. A. MACROPODA Dangeard

Dangeard, 1952, pp. 265-266, Fig. A, 1-4, pl. XVII

Distribution: Dakar, West Africa

On Dictyota dichotoma

117. A. MACROPUS Kylin

Kylin, 1919, p. 4, Fig. 2

De Toni, 1924, as Chantransia macropus

Kylin, 1944, p. 13, as Kylinia macropus

Papenfuss, 1945, p. 321, as Chromastrum macropus

_____, 1947, p. 437, as Kylinia macropus

Distribution: Tierra del Fuego and Falkland Islands

On Porphyra

118. A. MACULA (Rosenvinge) Hamel

Rosenvinge, 1909, p. 114, Fig. 42, as Chantransia macula

Hamel, 1927, p. 97

Papenfuss, 1945, p. 323, as Chromastrum macula

_____, 1947, p. 437, as Kylinia macula

Distribution: Denmark and west coast of Norway

On Polysiphonia

119. A. MAGNIFICUM (Drew) Papenfuss

Drew, 1928, p. 180, pl. 41, Figs. 38-40, as Rhodochorton magnificum

Papenfuss, 1945, p. 316

Distribution: California

On Palagophycus

120. A. MAHUMETANUM Hamel

Hamel, 1927, p. 34, Fig. 28

Distribution: Algiers

On Chaetomorpha and Ectocarpus

121. A. MANORENSE Anand

Anand, 1943

Distribution: Monora, Karachi, Pakistan

122. A. MAURITIANUM Børgesen

Børgesen, 1942, pp. 11-13, Fig. 3-4

Distribution: Mauritius

On Chaetomorpha aerea

123. A. MICROFILUM Jao

Jao, 1936, p. 240, pl. 10, Figs. 1-5

Taylor, 1937, p. 232, pl. 32, Figs. 1-5

_____, 1957, p. 219, pl. 32, Figs. 1-5

Distribution: New England

On Polysiphonia

124. A. MICROSCOPICUM (Nägeli) Nägeli

Nägeli, in Kützing, 1849, p. 640, as Callithamnion microscipicum

Nägeli, 1861, p. 407, Figs. 24-25

Hamel, 1927, p. 15, Fig. 15

Drew, 1928, p. 163, as Rhodochorton microscopicum

Schiffner, 1938, p. 83

Kylin, 1944, p. 13, as Kylinia microscopica

Papenfuss, 1945, as Chromastrum microscopicum

Papenfuss, 1947, as Kylinia microscopica

Funk, 1955, p. 61

Distribution: Northeastern Atlantic, Mediterranean, Adriatic and Pacific coast of North America

On a variety of algae

125. A. MINIMUN Collins

Collins, 1908, p. 133

Collins, 1911, p. 186, as Chantransia minima

Taylor, 1937, p. 237

_____, 1957, p. 222

Distribution: New England

On Desmerestia

126. A. MINUTISSIMUM (Zanardini) Nägeli

Zanardini, 1842, p. 176, pl. 2, Fig. 3, as Callithamnion minutissumum

Nägeli, 1861, p. 405

Hamel, 1927, p. 62, Fig. 40 e-k, as Rhodochorton velutinum

Papenfuss, 1945, p. 310

Distribution: Adriatic and Mediterranean

On Cystoseira

127. A. MINUTUM (Suhr) Hamel

Suhr, 1831, p. 727, as Callithamnion minutum

Kützing, 1861, p. 18, pl. 57, Fig. 1, as Callithamnion minutissimun

Nägeli, 1861, p. 405, as Acrochaetium minutissimum

Reinke, 1892, p. 59, pl. 40, as Rhodochorton minutum

Hamel, 1927, p. 9, 49, 101, and 111

Distribution: Baltic

On Polysiphonia

128. A. MOLLE (Pilger) Hamel

Pilger, 1911, p. 298, Figs. 8-9, as Chantransia mollis

Hamel, 1927, p. 102

Distribution: Cameroons

On Gracilaria

129. **A. MONILIFORME** (Rosenvinge) Børgesen

Rosenvinge, 1909, p. 99, Figs. 28-29, as Chantransia moniliformis

Børgesen, 1915, p. 22

Petersen, 1918, Figs. 1, 4

Drew, 1928, p. 164, as Rhodochorton moniliforme

Jao, 1936, p. 241, pl. 10, Fig. 15-17

Taylor, 1937, p. 227, pl. 32, Figs. 15-17

Levring, 1936, p. 87, as Chantransia moniliformis

Kylin, 1944, p. 16, as Kylinia moniliformis

Papenfuss, 1945, p. 322, as Chromastrum moniliformis

_____, 1947, p. 437, as Kylinia moniliformis

Taylor, 1957, p. 211, as Kylinia moniliformis, p. 212, pl. 32, Figs. 15-17

Etcheverry, 1960, p. 107

Distribution: Denmark, Sweden, Norway, Northeastern Pacific, Easter Islands, Mediterranean, Elizabeth Island, Massachusetts, Lescua Gulf (Chile)

On Dictyopteris repens, Mesogloia divaricata

130. **A. MULTISPORUM** Børgesen

Børgesen, 1937, p. 38, Figs. 22-23

Distribution: India

On Halymenia

131. **A. NAUMANNII** (Askenasy) Bornet

Askenasy, 1888, p. 31, as Chantransia naumannii

Bornet, 1904, p. xx

Hamel, 1927, p. 72, Fig. 43

Distribution: Atlantic coast of North Africa, New Zealand (Bay of Island)

On Codium

132. **A. NEMALIONIS** (De Notaris) Bornet

De Notaris in Ardissone, 1867, p. 17, tab. 1, Figs. 1-3 as Callithamnion nemalionis

Ardissone, 1883, p. 276 ex parte as Chantransia saviana

Ardissone and Strafforello, 1877, p. 167, as Chantransia nemalionis

Bornet, 1904, p. xx

Rosenvinge, 1909, p. 126, Figs. 53-54, as Chantransia nemalionis

Hamel, 1927, p. 30, Fig. 25 z

Børgesen, 1927, p. 32

Funk, 1955, p. 61

Taylor, 1960, p. 314

Distribution: Denmark, Mediterranean, Canary Islands and Bermuda

On Namalion, Liogora and Tamarix

133. **A. NEOZEELANDICUM** Levring

Levring, 1955, p. 413, Fig. 3

Distribution: Bay of Islands, Motu Arohia, New Zealand

On Rhodochorton rothii

134. **A. NETROCARPUM** Børgesen

Børgesen, 1915, p. 24, Figs. 17-18

De Toni, 1924, p. 55, as Chantransia netrocarpa

Phillips and Springer, 1960, p. 370

Taylor, 1960, p. 310

Distribution: Virgin Islands and Florida

On Caulerpa

135. **A. NITOPHYLII** (Levring) Papenfuss

Levring, 1937, p. 93, Fig. 15, as Chantransia nitophylli

Papenfuss, 1945, p. 316

Distribution: West coast of Norway

On Nitophyllum

136. **A. OBSCURUM** (Drew) Papenfuss

Drew, 1928, p. 193, pl. 48, Fig. 87, as Rhodochorton obscurum

Papenfuss, 1945, p. 316

Distribution: California

On Laminaria and Desmerestia

137. **A. OCCIDENTALE** Børgesen

Børgesen, 1915, p. 44, Figs. 42-43

De Toni, 1924, p. 69, as Chantransia occidentalis

Børgesen, 1927, p. 28-32, Fig. 16

Taylor, 1960, p. 314

Distribution: Virgin Islands and Canary Islands

On Liagora

138. **A. OPETIGENUM** Børgesen

Børgesen, 1915, p. 38, Figs. 35-37

De Toni, 1924, p. 41, as Chantransia opetigena

Taylor, 1960, p. 314

Distribution: Virgin Islands

On Dasya

139. **A. PACIFICUM** Kylin

Kylin, 1925, p. 11, Fig. 4 g-i

Drew, 1928, p. 169, pl. 38, Fig. 25, as Rhodochorton pacificum

Papenfuss, 1947, p. 435

Distribution: Pacific coast of North America, Juan Fernandez Islands

On Sertularia and various algae

140. **A. PALLENS** (Zanardini) Nägeli

Zanardini, 1845, p. 12, as Callithamnion pallens

Nägeli, 1861, p. 171

Hauck, 1878, p. 187, tab. II, Fig. 4-6, as Thamnidium pallens

Hauck, 1885, p. 69, as Rhodochorton pallens

Hamel, 1927, p. 48

Distribution: Adriatic

On larger algae

141. **A. PARVULUM** (Kylin) Hoyt

Kylin, 1906, p. 124, Fig. 9, as Chantransia parvula

_____, 1907, p. 114, as C. parvula

Rosenvinge, 1909, p. 91, Figs. 19-20, as Chantransia rhipindandra

Hoyt, 1920, p. 470, Fig. 25

Børgesen, 1927, p. 13, Fig. 6

Kylin, 1928, p. 5, Fig. 1-2, as Chantransia rhipidandra

Hamel, 1927, p.23, Fig. 20, as A. rhipidandrum; p. 24, Fig. 21-22, A. maluinum and A. rhipidandrum

Levring, 1940, p. 75, Fig. 22, as Chantransia parvula

_____, 1937, p. 83, as Chantransia rhipidandra

Kylin, 1944, p. 13, as Kylinia parvula

Papenfuss, 1945, p. 321, as Chromastrum maluinum; p. 322, as Chromastrum parvulum

_____, 1947, p. 437, as Kylinia parvula and as C. maluinum

Distribution: North Atlantic Coast of France and Denmark, Norway and Baltic

On Porphyra and Polysiphonia harveyi

142. A. PENETRALE (Drew) Papenfuss

Drew, 1928, p. 187, pl. 44, Figs. 57-58, pl. 45, Figs. 59-60, as Rhodochorton penetrale

Papenfuss, 1945, p. 316

_____, 1947, p. 436

Distribution: California, Pacific coast of Costa Rica

On Sertularia and Zoöbotrys

143. A. PENTRANS (Levring) Papenfuss

Levring, 1935, p. 436, Fig. 1

Papenfuss, 1945, p. 316

_____, 1947, p. 436

Distribution: West coast of Sweden

On Alcyonidium

144. A. PHACELORHIZUM Børgesen

Børgesen, 1915, p. 54, Figs. 57-59

De Toni, 1924, p. 65, as Chantransia phaclorhiza

Taylor, 1960, p. 315

Phillips and Springer, 1960, p. 370

Distribution: Virgin Islands and Florida

On Codium

145. **A. PLUMOSUM** (Drew) Smith

Drew, 1928, p. 173, pl. 39, Fig. 29, as Rhodochorton plumosum

Smith, 1944, p. 180

Distribution: California

On various members of Laminriales

146. **A. POLYBLASTUM** (Rosenvinge) Børgesen

Rosenvinge, 1909, p. 115, Fig. 43, as Chantransia polyblasta

Hamel, 1927, p. 95

Levring, 1935, p. 37, as Chantransia polyblasta

Papenfuss, 1945, p. 323, as Chromastrum polyblastum

_____, 1947, p. 437, as Kylinia polyblasta

Distribution: Denmark, west coast of Sweden

147. **A. POLYIDIS** (Rosenvinge) Børgesen

Rosenvinge, 1909, p. 132, Figs. 59-60, as Chantransia polyides

Børgesen, 1915, p. 59

Levring, 1935, p. 460, Fig. 3, as Chantransia polyides

Distribution: Denmark, West coast of Sweden and Norway

On Polyides

148. A. POLYRHIZUM (Harvey) J. Agardh

Harvey, 1863, p. LVI, as Callithamnion polyrhizum

Agardh, 1892, p. 45

Bornet, 1904, pp. XX

De Toni, 1903, 1905, p. 71

Hamel, 1927, p. 73

Distribution: Southern Australia

On Codium

149. A. POLYSPORUM Howe

Howe, 1914, p. 88, pl. 31, Figs. I-II

De Toni, 1924, p. 52, as Chantransia polyspora

Distribution: Peru

On Lessonia and Macrocystis

150. A. PORPHYRAE (Drew) Smith

Drew, 1928, p. 188, pl. 46, Figs. 70-75, as Rhodochorton porphyrae

Smith, 1944, p. 179, pl. 40, Figs. 8-9

Papenfuss, 1945, p. 325, as Chromastrum porphyrae

_____, 1947, p. 438, as Kylinia porphyrae

Distribution: California

On Porphyra

151. A. PULCHELLUM Børgesen

Børgesen, 1915, p. 23, Figs. 14-16

De Toni, 1924, p. 40, as Chantransia pulchella

Papenfuss, 1945, p. 323, as Chromastrum pulchellum

_____, 1947, p. 437, as Kylinia pulchella

Taylor, 1960, p. 300, as Kylinia pulchella

Distribution: Virgin Islands

On Cahetomorpha

152. A. PULVINATUM Levring

Levring, 1953, pp. 477, Fig. 12

Distribution: Moreton Island, Australia

153. A. PUNCTATUM Dawson

Dawson, 1952, p. 25, pl. 2, Fig. 1

Distribution: Sonora, Mexico

154. A. PUSILLUM Feldmann

Feldmann, 1954

Distribution: Roscoff, France

155. A. RADIANS Hamel

Hamel, 1927, p. 74, Fig. 44 a-f

Taylor, 1960, p. 309

Distribution: Island of Guadaloupe

156. A. RADIATUM Jao

Jao, 1936, p. 246, pl. 10, Figs. 18-25

Taylor, 1937, p. 237, pl. 32, Figs. 18-25

_____, 1957, p. 223, pl. 32, Figs. 18-25

Distribution: New England

On Polysiphonia

157. A. RALFSIAE Børgesen

Børgesen, 1923, p. 273, Figs. 18-19

De Toni, 1924, p. 711, as Chantransia ralfsiae

Distribution: Easter Island

On Ralfsia

158. A REDUCTUM (Rosenvinge) Hamel

Rosenvinge, 1909, p. 120, Fig. 49, as Chantransia reducta

Hamel, 1927, p. 95

Levring, 1937, p. 89

Distribution: Denmark, Sweden, Norway

On Polysiphonia and Rhodomela

159. A. REPENS Børgesen

Børgesen, 1915, p. 52, Figs. 55-56

_____, .920, p. 453, Figs. 420

De Toni, 1924, p. 64, as Chantransia repens

Taylor, 1960, p. 315

Distribution: Virgin Islands

On Hypnea and Griffithsia

160. **A. RETICULATUM** (Batters) Papenfuss

Batters, 1896, p. 8, as Colaconema reticulatum

Chemin, 1926, p. 982, Figs. 1-5, as Colaconema reticulatum

Knight and Parke, 1931, p. 77, 114 as Colaconema reticulatum

Papenfuss, 1945, p. 317

Distribution: England and Atlantic coast of France

On Desmerestia

161. **A. RHIZOIDEUM** (Drew) Jao

Drew, 1928, p. 182, pl. 42, Figs. 42-44, as Rhodochorton rhizoideum

Jao, 1937, p. 102

Smith, 1944, p. 180

Papenfuss, 1945, p. 317

_____, 1947, p. 436

Distribution: Pacific coast of North America

On Codium and Cystophyllum

162. **A. ROBUSTUM** Børgesen

Børgesen, 1915, p. 40, Figs. 38-40

_____, 1920, p. 449, Fig. 418

_____, 1932, p. 115, Figs. 3-5, as A. sargassicolum

Nakamura, 1941, p. 284, Figs. 10-13, as Rhodochorton robustum

Papenfuss, 1945, p. 317

Williams, 1948, p. 690

_____, 1951

Taylor, 1960, p. 315

Durairatnam, 1961, p. 49, pl. II, Figs. 1-2 as A. sargassicola

Distribution: North Carolina, Virgin Islands, Japan, Hong Kong, India and Ceylon

On Sargassum, Codium, Turbinaria, Padina, and Stoechospermum

163. A. RONGELAPENSE Abbott

Abbott in Taylor, 1950, p. 117

Distribution: Rongelap Atoll, Bikini

On Liagora hawaiiana

164. A. RYUKYUENSE (Nakamura) Papenfuss

Nakamura, 1941, p. 275, Figs. 2-3, as Rhodochorton ryukyuense

Papenfuss, 1945, p. 307

Distribution: Japan

On Sphacelaria and Galaxaura

165. A. SAGRAEANUM (Montagne) Bornet

Montagne, 1856, p. 450, as Clodophora sagraeana

Bornet, 1904, p. XXI

Collins and Harvey, 1917, p. 97

De Toni, 1924, p. 51, as Chantransia sagraeana

Hamel, 1927, p. 77, Fig. 46

Taylor, 1937, p. 233

_____, 1957, p. 220

_____, 1960, p. 309

Phillips, 1960, p. 241

Humm, 1962, p. 250

Distribution: West Indies and Bermuda, New England, Mexico, Florida

On Zostera, Stypopodium and Dictyopteris, Ruppia, Thalassia

166. **A. SANCTAE-MARIAE** (Darbishire) Hamel

Darbishire, 1910, p. 41, Figs. 1-2, as Chantransia sanctae-marie

Hamel, 1927, p. 93

Newton, 1931, p. 256

Distribution: England

On Himanthalia

167. **A. SANCTI-THOMAE** Børgesen

Børgesen, 1915, p. 30, Figs. 23-24

De Toni, 1924, p. 53, as Chantransia sancti-thomae

Nakamura, 1941, p. 280, Fig. 5-7, as Rhodochorton sancti-thomae

Phillips, 1960, p. 241

Taylor, 1960, p. 310

Distribution: Virgin Islands, Japan, Florida

On Sargassum, Ecklonia, Thalassia, and Spyridia filamentosa

168. A. SARGASSI Børgesen

Børgesen, 1915, p. 17, Figs. 7-10

De Toni, 1924, as Chantransia sargassi

Taylor, 1928, p. 134, pl. 22, Figs. 1-5

_____, 1960, p. 306

Phillips, 1960b, p. 242

Distribution: Virgin Islands, Florida, East Indies

On Sargassum, Padina, Pocockiella, Diplenthera, Syringodium Ruppia and a Bryozoan

169. A. SAVIANUM (Meneghini) Nägeli

Meneghini, 1840, NC, as Callithamnion savianum

Kützing, 1849, p. 641, as Callithamnion savianum

Ardissone, 1883, p. 276

Hamel, 1927, p. 41, Fig. 32

Distribution: Genoa, Mediterranean coast of France

On Zostera, Posidonia

170. A. SCINAIAE Dawson

Dawson, 1949, p. 3, pl. 2, Figs. 11-12

Distribution: California, U.S.A.

171. A. SECUNDATUM (Lyngbye) Nägeli

Lyngbye, 1819, p. 129, pl. 41, Fig. B 4-6 as *Callithamnion daviesii secundatum*

Nägeli, 1861, p. 405

Børgesen, 1902, p. 350, Fig. 51, as *Chantransia secundata*

Kylin, 1907, p. 115, Fig. 24, as *C. secundata*

Newton, 1931, p. 254

Taylor, 1937, p. 230, pl. 31, Figs. 1-3

_____, 1957, p. 214, pl. 31, Figs. 1-3, as *Kylinia secundata*

Papenfuss, 1945, p. 323, as *Chromastrum secundatum*

_____, 1947, p. 437, as *Kylinia secundata*

Distribution: North Atlantic and Adriatic

On *Porphyra*, *Peyssonelia*

172. **A. SERIATUM** Børgesen

Børgesen, 1915, p. 32, Figs. 25-28

De Toni, 1924, p. 53, as *Chantransia seriatum*

Hamel, 1927, p. 99

Williams, 1948, p. 690

Humm and Caylor, 1957, p. 250, pl. 7, Fig. 5

Taylor, 1960, p. 310

Phillips and Springer, 1960, p. 370

Phillips, 1960a, p. 333

_____, 1960b, p. 242

_____, 1961, p. 140

Humm, 1962, p. 250

Distribution: Virgin Islands, Florida, Texas, Ship Island (Mississippi Sound), East Indies, Mexico

On Posidonia, Diplanthera, Thalassia, Syringodium, Gelidium crinale, Gracilaria foliifera, Sargassum filipendula

173. **A. SEIRIOLANUM** (Harvey-Gibson) Rosenvinge

Harvey-Gibson, 1891, p. 204, pl. 34, Figs. 1-5, as Rhodochorton seiriolanum

Børgesen, 1902, p. 396, as R. seiriolanum

De Toni, 1905, p. 1512, as R. seiriolanum

Rosenvinge, 1909, p. 290

Distribution: England and Faroe Islands

On Polysiphonia, Ceramium

174. **A. SESSILE** (Nakamura) N. Comb.

Nakamura, 1941, p. 278, Fig. 4, as Rhodochorton sessile

Papenfuss, 1945, p. 323, as Chromastrum sessile

_____, 1947, p. 437, as Kylinia sessilis

Distribution: Japan

On Hyalosiphonia

175. **A. SIMPLEX** (Drew) Papenfuss

Drew, 1928, p. 165, pl. 37, Figs. 4-11, as Rhodochorton simplex

Papenfuss, 1945, p. 307

Distribution: California

On Ectocarpus

176. **A. SINICOLUM** (Dawson) Papenfuss

Dawson, 1944, p. 256, pl. 41, Fig. 1-2, as Rhodochorton sinicola

_____, 1954, p. 1-7

Papenfuss, 1945, p. 317

Distribution: Gulf of California and Gulf of Thailand

On Dictyota

177. **A. SPARSUM** (Harvey) Nägeli

Harvey in Hooker, 1833, p. 348

_____, 1851, p. 3, pl. 297, as Callithamnion sparsum

Nägeli, 1861, p. 405

Batters, 1896, p. 389-390

_____, 1902, p. 58

Distribution: England and Ireland

On Laminaria and Cladophora

178. **A. SPATHOGLOSSI** Børgesen

Børgesen, 1937, p. 30, Fig. 14

Distribution: India

On Spathoglossum

179. **A. SPERMATOCHNI** Feldmann

Feldmann, 1954

Distribution: Roscoff, France

180. **A. SPICULIFILUM** Dawson

Dawson, 1952, p. 22, pl. 10, Figs. 2-4

Distribution: Baja California, Mexico

On sponge

181. **A. SPONGICOLUM** Weber-van Bosse

Weber-van Bosse, 1921, p. 195, Figs. 56-57

Distribution: East Indies

On sponges

182. **A. STILOPHORAE** (Levring) Kylin

Levring, 1935, p. 39, Fig. a-e

Papenfuss, 1945, p. 325, as Chromastrum stilophorae

_____, 1947, p. 438, as Kylinia stilophorae

Distribution: West coast of Sweden

On Stilophora

183. **A. STRICTUM** (Rosenvinge) Hamel

Rosenvinge, 1909, p. 108, Fig. 36, as Chantransia stricta

Hamel, 1927, p. 101

Levring, 1935, p. 36

Distribtuion: Denmark, West coast of Sweden and Norway

On Polysiphonia, Ceramium and Cystoclonium

184. **A. SUBIMMERSUM** (Setchel and Gardner) Papenfuss

Setchell and Gardner, 1903, p. 347, pl. 17, Fig. 12

Drew, 1928, p. 191, pl. 47, Fig. 81

Nakamura, 1941, p. 290, Fig. 17, as Rhodochorton subimmersum

Papenfuss, 1945, p. 318

Distribution: Pacific coast of North America and Japan

On Grateloupia and other membranaceous Rhodophyceae

185. **A. SUBREDUCTUM** Levring

Levring, 1953, p. 480, Fig. 13 A-E

Distribution: Victoria, San Remo, Kangaroo Island, Pennington Bay, Cape du Coude (all in Australia)

186. **A. SUBSERIATUM** Børgesen

Børgesen, 1932, p. 118, Figs. 6-7

Børgesen, 1942, p. 15, Fig. 6

Distribution: India and Mauritius

On Chondria and Griffithsia

187. **A. SUBSIMPLEX** Levring

Levring, 1953, p. 473, Fig. 10 A-D and H

Distribution: Northeast Tasmania, Musselroe Bay, Australia

188. **A. SUBPINNATUM** Bornet ex Hamel

Hamel, 1927, p. 19, Fig. 17

Distribution: Mediterranean

On Chaetomorpha

189. **A. SUBTILISSIMUM** (Kützing) Hamel

Kützing, 1861, XI p. 19, as Callithamnion subtilissimum

Crouan, 1867, p. 134, as Callithamnion daviesii

Bornet, 1904, p. XIX, as Ceramium roseolum

Hamel, 1927, p. 86

Distribution: Atlantic coast of France

On Dudresnaya, Stilophora and Ceramium

190. **A. TENUISSIMUM** (Collins) Papenfuss

Collins in Collins, Holden J. and **W.A.** Setchell, 1900, no. 741, as Chantransia virgatula f. tenuissima

_____, 1906, p. 194, as **A**crochaetium virgatulum f. tenuissima

Drew, 1928, p. 170, pl. 38, Figs. 26-27, as Rhodochorton tenuissimum

Kylin, 1941, p. 5, Fig. I e-f

Papenfuss, 1945, p. 319

Distribution: San Pedro (California)

On Zostera

191. **A.** THURETII (Bornet) Collins and Harvey

Bornet, 1904, XVI, pl. I, as Chantransia efflorescens var.

Thuretii

Kylin, 1907, p. 119, as Chantransia thuretii

Rosenvinge, 1909, p. 100, Figs. 30-33, as Chantransia thuretii

Collins and Hervey, 1917, p. 97

Hamel, 1927, p. 37, Fig. 30

Taylor, 1937, p. 236

Papenfuss, 1945, p. 311

Papenfuss, 1947, p. 435

Taylor, 1957, p. 222

_____, 1960, p. 310

Dixon, 1961

Distribution: North Atlantic, Channel Islands, Juan Fernandez Islands

On Dictyota and Splachnidium and other algae

192. A. TRICHOGLOEAE Børgesen

Børgesen, 1952, p. 13, Figs. 6-7

Distribution: Barkly Island, Mauritius

On Trichogloea requienii

193. A. TRIFILUM (Buffham) Batters

Buffham, 1892, tab. III, Figs. 1-4, as Chantransia trifila

Batters, 1902, p. 58

Hamel, 1927, p. 12, Figs. 14 A-D

Distribution: England, Atlantic coast of France, Mediterranean and Adriatic

On Cladophora, Chaetomorpha and Acrochaetium virgatulum

194. A. TUTICORINENSE Børgesen

Børgesen, 1937, p. 30, Figs. 15-16

Distribution: India

On Sea grass

195. A. UNIFILUM Jao

Jao, 1936, p. 239, pl. 10, Figs. 26-32

Taylor, 1937, p. 228, pl. 32, Figs. 26-32

_____, 1957, p. 212, pl. 32, Figs. 26-32, as Kylinia unifila

Papenfuss, 1945, p. 322, as Chromastrum unifilum

_____, 1947, p. 437, as Kylinia unifila

Distribution: Norton Point, Massachusetts

On Arthrocladia villosa

196. A. UNILATERALE (Kjellman) Hamel

Kjellman, 1906, p. II, pl. 2, Figs. 1-4, as Chantransia unilateralis

Hamel, 1927, p. 84

Distribution: Island on Jan Mayen (Arctic)

On Halosaccion

197. **A. UNIPES** Børgesen

Børgesen, 1915, p. 35, Figs. 31-34

_____, 1920, p. 451

Børgesen, 1924, p. 26

Howe and Hoyt, 1916, p. 118

De Toni, 1924, p. 42, as Chantransia unipes

Phillips and Springer, 1960, p. 370

Taylor, 1960, p. 316

Distribution: Virgin Islands, Florida, Hispaniola

On Dictyota

198. **A. VAGUM** (Drew) Jao

Drew, 1928, p. 188, pl. 45, Figs. 61-69, as Rhodochorton vagum

Jao, 1937, p. III

Papenfuss, 1945, p. 318

Distribution: Pacific coast of North America

On Pterosiphonia

199. **A. VANBOSSEAE** Papenfuss

Weber van Bosse, 1914, p. 275, as Chantransia liagorae

Hamel, 1927, p. 92, as Acrochaetium liagorae

Papenfuss, 1945, p. 318

Distribution: Coetivy Reef (Western Indian Ocean)

On Liagora

200. A. VARIABILE (Drew) Smith

Drew, 1928, p. 174, pl. 38, Fig. 28, pl. 39, Figs. 30-31 as Rhodochorton variabile

Smith, 1944, p. 179

Distribution: Pacific coast of North America

On a variety of algae

201. A. VILLIFORME Levring

Levring, 1953, p. 481, Figs. 15 D-E, 16 and 17

Distribution: Kangaroo Island, Australia

202. A. VIRGATULUM (Harvey) Agardh

Harvey, 1833, p. 349, as Callithamnion virgatulum

Le Jolis, 1863, p. 106, as Chantransia virgatula

Agardh, 1892, p. 48

Batters, 1902, p. 58

Børgesen, 1902, p. 351, as Chantransia virgatula

Bornet, 1904, p. XXIII

Rosenvinge, 1909, p. 109, as Chantransia virgatula

Børgesen, 1927, p. 14, Figs. 7-8

Hamel, 1927, p. 45

Taylor, 1937, p. 230

Papenfuss, 1945, p. 323, as Chromastrum virgatulum

_____, 1947, p. 437, as Kylinia virgatula

Williams, 1948, p. 690

Funk, 1955, p. 62

Taylor, 1957, p. 214, as Kylinia virgatula

Distribution: North Atlantic, Baltic, Mediterranean, and North Carolina

On Gracilaria foliifera, Agardiella tenera, Rhodymenia palmetta, Codium tomentosum, Caulerpa, Acetabularia, Dictyota and Padina

203. A. ZOSTERAE Papenfuss

Jao, 1936, p. 243, pl. II, Figs. 5-7, as Acrochaetium subseriatum

Taylor, 1937, p. 232, pl. 33, Figs, 5-7, as A. subseriatum

Papenfuss, 1945, p. 307

Taylor, 1957, p. 218-219, pl. 33, Figs. 5-7

Distribution: New England

On Zostera

DISCUSSION

Nature of the Genera

The genera Acrochaetium and Kylinia, family Acrochaetiaceae, are representatives of the most primitive order, the Acrochaetiales, of the subclass Florideae. The plants are so small that only a few are conspicuous enough to be recognized with the unaided eye. For the most part, therefore, they were searched for among collections of algae, invertebrates and debris with the aid of a stereoscopic microscope. Endophytic species are easily overlooked unless sections of the host plant are made. Tedious dissections are necessary to separate the plants from their host or substratum and obtain all of the basal parts, essential for a proper determination.

Countless collections from many areas along the Atlantic coast of the United States at various times of the year were examined in detail during the past five years. By this means it has been possible to observe and record the

seasonal and environmental variations of many species. In the case of Acrochaetium trifilum, with which several other species have been merged as a result of this work, thousands of specimens from the Eastern Shore of Virginia to the Florida Keys and around the coast of the Gulf of Mexico, including the Yucutan peninsula and Alacran Reef, were examined before the synonomy could be established.

Further critical studies are likely to result in the discovery of new species and the synonomy of species now regarded as different. It is estimated by the writer that considerably less than half of the existing species of Acrochaetium and Kylinia have been described.

Fundamental Generic Characters

Rosenvinge (1909) did not recognize Acrochaetium Nägeli but grouped these plants under Chantransia De Candolle. He erected Kylinia Nov. Gen. with a single species K. rosulata. According to Rosenvinge this genus differs from Acrochaetium by the possession of androphores (special colorless branches) on which the spermatangia are produced and by the development and the structure of the cystocarps. Kylin (1944) came to the conclusion that the androphores observed by Rosenvinge are merely hairs on which spermatangia were accidentally attached.

Thus, according to Kylin the separation of Kylinia from Acrochaetium, based on the presence of androphores, could no longer hold. He redefined the genus Kylinia. He assigned all of the species of Acrochaetium with a unicellular base to the genus Kylinia. Levring (1953) described Kylinia australis. The spermatangia, in this species, are borne on special short androphore filaments. It is possible that Rosenvinge might not have been wrong in the observation of androphores. Feldmann (1958) studied the developmental stages of Kylinia rosulata and showed beyond any doubt that Rosenvinge was correct in the observation of the androphores as spermatangia bearing structures. The description, in this paper, of another new species of Kylinia, with distinct androphores further supports the concept of Rosenvinge. K. blomquistii n. sp. has the longest androphores so far described. In the light of all these studies Kylin's concept of the genus Kylinia, based on unicellular holdfasts, must be discarded.

Papenfuss (1945) proposed the genus Chromastrum based on chromatophores. Accordingly, he transferred all the species with stellate chromatophores, of this Acrochaetium-Kylinia complex, to the genus Kylinia. Later, he followed the ideas of Kylin (1944), and decided that the genus Chromastrum should be discarded and all the species with stellate chromatophore should

be classified under the genus Kylinia (Papenfuss 1947). This offered still another concept of the genus Kylinia, the basis of which was Kylin's observation that Kylinia rosulata Rosenvinge has stellate chromatophores. Papenfuss argued also that Nägeli, when establishing the genus Acrochaetium, made no mention of the chromatophore. Apparently, Papenfuss overlooked the part of Nägeli's publication where Nägeli mentioned the genus Acrochaetium having both stellate and parietal chromatophores. To add to this, Feldmann (1958) came to the conclusion that Kylin identified another plant as K. rosulata. The specimen Kylin observed had single stellate chromatophores in the cells and was described as Acrochaetium kylinoides by Feldmann (1958). Feldmann reasserted that Kylinia rosulata has parietal chromatophores. The writer has examined many fresh plants from North Carolina which have both band-shaped parietal and axial stellate chromatophores. In Pl. XII, Fig. 3, a photomicrograph shows the extent of variation within the stellate chromatophore. In one erect branch the stellate chromatophore with four rays almost approaches a band shaped chromatophore. Many examples have been observed where the chromatophores are band shaped excepting the monosporangia, where the chromatophore is stellate.

Papenfuss (1945) has also proposed including species with many discoid chromatophores in Rhodochorton. The author

has examined numerous fresh materials from the coasts of North Carolina, Oregon, and Washington and found that the same plant, in many cases, has a single parietal chromatophore in the erect epiphytic part and many discoid chromatophores in the prostrate endophytic part. In this regard the writer showed some of these specimens to Dr. Shirley Sparling and Dr. V.J. Chapman while he was working in the Oregon Institute of Marine Science, and to Dr. E.Y. Dawson while in Friday Harbor Marine Laboratory, Washington, in the summer of 1963. The above mentioned algologists agreed that chromatophore characteristics could not be used for the separation of Acrochaetium and Rhodochorton. In the Atlantic Coast a good example of this chromatophore pattern is found in A. infestans. Besides the difference in chromatophore characteristics, A. infestans has endophytic and epiphytic filaments remarkably different in respect to size and shape (Pl. II, Fig. 17). In the light of present knowledge, the distinction of Acrochaetium from Rhodochorton based on chromatophore characteristics as proposed by Papenfuss is untenable.

Evolutionary Speculations

The variation in the environment such as, temperature and light intensity along with the diversity of habitats

available for the growth of Acrochaetium provided opportunity for Acrochaetium-like plants to evolve in many directions. Genetic variation in the plants is a prerequisite for adaptation to new environments, and selection is probably based on the nature of the holdfast and on the mode of asexual and sexual reproduction. The nature of the holdfast or basal part of the plant is of special importance. Thus "holdfast" should mean the endophytic part of the plant, except in the cases of the totally endophytic species and other modes of epiphytic attachments.

It appears that the following generalizations can be made about the genus Acrochaetium in regard to a few key characters:

1. Unicellular holdfast in the form of the persistent original spores is more primitive than a multicellular holdfast.
2. Filamentous holdfast is more primitive than pseudoparenchymatous holdfast.
3. Epiphytic habit is more primitive than endophytic habit.
4. Non-parasitic habit is more primitive than semi-parasitic habit.

The more primitive nature of a unicellular holdfast is not unique in this genus. The genus Erythrotrichia has a

unicellular holdfast and belongs to the sub-class Bangioideae, a more primitive group of Rhodophyta. In Chlorophyta, Fritsch (1935) used the unicellular holdfast as a primitive character in contrast to a multicellular holdfast. In the genus Acrochaetium, A. sargassi, A. trifilum and A. dufourii are examples of plants having a unicellular base. A. affine has basically a unicellular base, but sometimes the single basal cell gives rise to a few secondary cells of attachment. This species thus exhibits an intermediate condition between plants having a simple unicellular base and plants having a complex multicellular base.

Most species of Acrochaetium, however, have a filamentous base. A. hummii, A. hypneae, A. infestans and A. reniforme are a few examples of this category. Species having a distinct original spore and a filamentous base can be considered as intermediate forms. A. radians, A. occidentale, A. bornetii and A. alacranense are a few examples of this intermediate type.

A filamentous base is of more primitive nature than a pseudoparenchymatous base. Fritsch (1935) regarded a filamentous base as more primitive than a pseudoparenchymatous one. In the genus Acrochaetium, A. thuretii and A. virgatulum have this type of base.

Epiphytic habit may be considered more primitive than endophytic habit, and epi-endophytic species may be considered intermediate forms.

In the genus Acrochaetium, A. seriatum, A. sancti-thomae and A. stypopodiae are a few examples of the type that are entirely external to the host. A. liagorae and A. acanthophorae are examples of plants which are entirely endophytic in habit. Most species of Acrochaetium, however, lie in between these two extremes and are epi-endophytic in nature. Examples of plants having epi-endophytic nature are A. hormorhizum, A. repens, A. hypneae and A. islamii.

Non-parasitic habit may be considered to be more advanced than semi-parasitism. A. elegans is an example of a semi-parasitic species. Most species are non-parasitic, for example A. trifilum.

Acrochaetium-like plants are probably a link between the sub-classes Bangioideae and Floridae of the Rhodophyta. There is little morphological difference from unbranched species of Bangioideae which have a unicellular base to branched forms of Acrochaetium with a unicellular base. A similar evolutionary line from unbranched filamentous forms like Ulothrix to branched filamentous forms like Stigeoclonium is present in Ulotrichales of Chlorophyta. In both vegetative organization and sexual reproduction, Acrochaetiales come between Bangiales and Nemalionales. Nemalionales is the only other group of Rhodophyta which does not have a diploid

carposporophyte. Bangiales and Acrochaetiales are also devoid of a diploid carposporophyte. Only recently the writer has discovered two-celled carposporophytes in Erythrotrichia carnea from Beaufort, North Carolina (unpublished data). The mode of development of carposporophytes in Bangiales is the same as in Acrochaetiales. In one line, Acrochaetium-like plants probably gave rise to a more complex vegetative organization which resulted in the plants belonging to the order Nemalionales. In another line, evolution took place within the order Acrochaetiales, where evolution took place along the line of dimorphism.

Plants of Kylinia bear spermatia on special colorless filaments known as androphores, and the male plants are generally reduced. K. blomquistii has longer androphores than the rest of the species of Kylinia. These long androphores may be considered as intermediate between a normal filament of Acrochaetium bearing spermatangia and the extremely reduced spermatangia bearing filaments (androphores) that produce spermatangia in K. rosulata and K. australis.

Sexual Reproduction and Life Histories

Sexual reproduction is unknown in many species of Acrochaetium although further critical observations are likely to result in the discovery of sexual reproduction in some of

these. In the present study, sexual reproduction has been found for the first time in A. dasyae, A. daviesii and A. liagorae. In A. dasyae the developmental sequence was traced from the early stages of spermatangial and carposporangial clusters to their maturity (Plate I). The germinating stages of the carpospores were also observed. Asexual reproduction in A. dasyae is by monospores. However, it is not possible to distinguish male and female plants when the plants are not reproducing sexually. Unlike the carposporophytes of advanced Florideae, the carposporophytes of A. dasyae and plants having a similar life cycle, probably are haploid. In A. daviesii only female plants, distinguished by the presence of carposporophytes, were observed. Although spermatangial clusters were not observed in this species, it is probable that A. daviesii is dioecious and has the same pattern of life cycle as A. dasyae. The carposporophyte of the former species also resembles the carposporophyte of A. dasyae in its cluster-like habit. Both A. dasyae and A. daviesii produce carposporangia in clusters, thus making the carposporophyte very distinct from the monosporangia.

In A. liagorae the carposporophyte is a single cell and has similar dimensions to the monosporangia. Hence it is very difficult to distinguish carposporangia from monosporangia in this species. The life cycle of A. liagorae differs from

the A. dasyae type in that the former species bears both the spermatangia and carpogonia on the same plant, often on the same branch. Thus one good way of locating carposporangia in this species is to find the spermatangia or their empty walls. In most cases, spermatia produced on the same branch as carpogonia mature earlier than the spermatia. It is possible, however, that self-fertilization may occur in some cases.

In A. hummii the carposporophyte is solitary and resembles monosporangia, as in A. liagorae; but the life cycle is of the general pattern of A. dasyae.

Substrata

An enormous variety of substrata are available in marine habitats. Species of Acrochaetium are epiphytic, epi-endophytic, endophytic, epi-endozoic or lithophytic. If those species which are strictly epiphytic are taken into consideration, it is immediately apparent that not only the texture of the substratum but also its chemical nature could determine which species of Acrochaetium can grow on it. Genera like Porphyra, Nemalion, Liagora, Amphiroa, Acanthophora, Polysiphonia, (Rhodophyta); Sargassum, Desmarestia, Alaria, (Phaeophyta); Avrainvillea, Codium, Cymopolia, (Chlorophyta) and Zostera,

(Angiospermae) exemplify but few of the wide variety of suitable surfaces.

Most of the genera mentioned serve as host for at least one species of Acrochaetium which is known to be restricted to a single host. A. porphyrae has been reported only on Porphyra, A. liagorae on Liagora, A. amphiroae on Amphiroa, A. acantho-phorae on Acanthophora, A. radiatum on Polysiphonia, A. desmarestiae on Desmarestia, A. avrainvillae on Avrainvillea, A. codii on Codium, A. cymopoliae on Cymopolia and A. zosterae on Zostera. A. nemalionis was originally known to grow only on Nemalion, but now it is known also on Liagora and Tamarix.

Acrochaetium trifilum is an example of a species which grows on a wide variety of substrata. It is known to grow on Bangia, Acrochaetium, Jania, Callithamnion, Centroceras, Spyridia, Dasya, Polysiphonia, Chondria, Acanthophora, (Rhodophyta); Sargassum, Sphacelaria, (Phaeophyta); Chaetomorpha, Cladophora, Bryopsis, (Chlorophyta); Zostera (Angiospermae); hydroids and many other substrata. A. trifilum is one of the species least discriminatory to the substratum on which it grows, in contrast to the many host-specific species.

Animals also provide a wide range of variations in substrata for the growth of epi-endozoic forms of Acrochaetium. Sponges, bryozoans, tunicates, hydroids and crustaceans offer

quite different substrata which vary in their physical and chemical nature. A. episculum has been found only on sponges (Zygomycale parishii); A. alcyonidii, only on a Bryozoan (Alcyonidium verillii); A. penetrale, on Sertularians and Zoobotrys; and A. effusum, on hydroids. A. infestans grows on a variety of substrata such as various hydroids and bryozoans, all of which are animals. A. pacificum, on the other hand, is a species which grows on both animals and plants, e.g. on sertularians and various algae. Recently the writer has found a species of Acrochaetium on a crustacean (Caprella geometrica). It is probable that Acrochaetium grows on a much wider range of animals than is known at this time.

Nutrition

Most of the species of Acrochaetium are non-parasitic and use their host only for attaching themselves. But in some species clear cases of parasitism are evident: A. elegans, A. porphyrae, A. coccineum and A. obscurum are examples. A. elegans grows epi-endophytically on Eisenia arborea. The area which A. elegans covers on E. arborea is marked by empty cells and fragments of cell walls of the host. The author has observed various degrees of mild parasitism in several other

species of the Pacific Coast of North America; however, none of the species is totally parasitic. They also carry on photosynthesis. This semi-parasitic nature may be regarded as a greater degree of specialization than that exhibited by those epiphytic species that apparently are not at all parasitic. It is possible that some species are entirely parasitic, but no such case is known so far.

Intertidal Zone

The intertidal zone offers a unique environment, especially on the coasts where there is a considerable degree of fluctuation between low and high tide (3 ft. to 40 ft.). In general, most species of Acrochaetium grow below the low tide line. Because of their delicate filamentous nature they are prone to drying out in the intertidal zone unless there is continuous wave action and spray to keep them wet. Some species growing in the intertidal zone seem to have circumvented the dessication problem by their endophytic habit. A. implicatum, for example grows abundantly in Halosaccion glandiforme. The latter has a tough outer wall and a sac in the center in which it always retains water, and thus it has no drying problem. A. erythrophyllum is mostly intertidal and is almost wholly endophytic in Erythrophyllum delesserioides. Both in the case

of A. implicatum and A. erythrophyllum drying would mean drying of the hosts. The hosts, however, are adapted to the intertidal zone. A. hummii, primarily an epiphytic species, is an example of the plants that are prone to drying. This species grows abundantly in the intertidal zone but only where the plants get a constant spray from wave action. Species like A. sargassi, A. hoytii, A. dasyae and A. sagraeanum grow in shallow water, always below the low tide line.

Light

The effect of the depth of water and consequent decrease in the intensity of light offers a different kind of environment. Some species are adapted so that they can grow only in deep waters. A. opetiqenum, for example, is known from a depth of about 66 ft. and is not known from shallow water. Clarity of water is also important, since it affects light penetration directly. A. hummii and A. repens may be cited as examples of species that grow in shallow water and probably need high light intensity for their growth. A. thuretii, however, is known to occur in 6-102 ft. depth.

Temperature

Temperature plays a great role in the distribution of various species of Acrochaetium. Many species grow in colder water (temperate); others grow in warmer waters (tropical); and a few species grow in a wide range of temperature. A. alariae, A. compactum, A. erythrophyllum and A. desmarestiae are examples of cold water species. A. hormorhizum, A. avrainvillae, A. liagorae and A. seriatum are examples of warm water species. A. daviesii, A. flexuosum, A. virgatulum and A. trifulum are eurythermal, occurring from New England to the tropics.

Distribution

Although some species of Acrochaetium are restricted to certain areas because of environmental factors and geographical separation of various coasts by either large land masses or large bodies of water, some other species are found to be cosmopolitan (Pl. XVI). In many cases the distribution of the species of Acrochaetium are restricted to the distribution of their host. It is the author's speculation that the genus Acrochaetium occurs wherever marine benthic plants grow. At

this stage it seems best not to endeavour to draw distribution maps for individual species.

Proposed Classification

It is proposed that the genera Acrochaetium and Kylinia be treated as follows:

Phyllum Rhodophyta

Class Florideae

Order Acrochaetiales[1]

Family Acrochaetiaceae

Plants of simple organization, uniseriate, branched or unbranched, filamentous; base of the plant sometimes parenchymatous (one layer thick) or pseudoparenchymatous, but never of any complex organization; asexual reproduction by haploid, mono-, bi-, tri- or polysporangia; sexual plants monoecious or dioecious, with haploid phase dominant in the life cycle, diploid phase presumably represented only by the zygote, which immediately undergores reduction division;diploid carposporophytic or tetrasporophytic phases absent; carposporophyte, when present, haploid.

The genera Acrochaetium Nägeli and Kylinia Rosenvinge should be separated on the basis of absence or presence of

---

1 Classification according to Feldmann 1962.

androphores (special filaments bearing spermatangia, more or less colorless), as originally proposed by Rosenvinge. The separation of Acrochaetium and Kylinia based on the type of holdfast (unicellular versus multicellular), as proposed by Kylin or based on the chromatophore (parietal versus stellate) as proposed by Papenfuss, should be discarded.

Species that have diploid carposporophytic or tetrasporophytic phases but resemble Acrochaetium in other respects belong to the genus Rhodochorton. Rhodochorton should be classified in the order Ceramiales.

It is also proposed that the genus Acrochaetium be divided into the following categories:

Section I

Plants epiphytic, epi-endophytic, epi-endozoic or lithophytic, with at least some vegetative part of the plant growing beyond the host surface.

Subsection 1

Plants with primarily unicellular base.

Subsection 2

Plants with multicellular base, loosely filamentous or aggregated into a pseudoparenchymatous disc.

Section II

Plants completely endophytic, except that the sporangia may be borne outside the host.

Further studies are needed for the elucidation of the life cycle of many species of Acrochaetium. Cultural, cytological and transplantation work can be of great help in the understanding of the genera Acrochaetium and Kylinia.

SUMMARY

A study has been made of the genera Acrochaetium Nägeli and Kylinia Rosenvinge (Rhodophyta, Achrochaetiales, Achrochaetiaceae) along the southeastern coast of the United States, the Gulf of Mexico, and the West Indies.

Eight new species of Acrochaetium Nägeli and one of Kylinia Rosenvinge are described. They are A. acanthophorae, A. alacranense, A. chondriae, A. galaxaurae, A. hummii, A. islamii, A. reniforme, A. stypopodiae, and Kylinia blomquistii. Twenty-three species of Acrochaetium were examined from various localities and major herbaria in the eastern United States. The variations in the specimens examined were noted and in most cases the known geographical distribution of the species was extended.

Sexual reproduction in A. dasyae, A. daviesii, and A. liagorae is reported for the first time. It is proposed that A. intermedium Jao be merged with A. dasyae Collins. The writer came to the conclusion that A. trifilum (Buffham)

Batters, A. parvulum (Kylin) Hoyt, A. moniliforme (Rosenvinge) Børgesen, A. maluinum Hamel, A. crassipes (Børgesen) Børgesen, A. compactum Jao and Chantransia hallandica Kylin var. parvula (Kylin) Rosenvinge are one and the same species. A. trifilum (Buffham) Batters is considered to be the valid name.

A list of species of Acrochaetium from all the oceans was made with references, synonyms, distribution and hosts. A. balticum (Rosenvinge) Nov. Comb., A. hirsutum (Drew) Nov. Comb., A. sessile (Nakamura) Nov. Comb. and A. deliseae Nom. Nov. was established.

It is proposed that the genus Acrochaetium be divided into two sections depending on whether the plants grow completely inside the host (sometimes excluding the sporangia) or whether parts or the entire plant grow on the surface of the host. The latter section was divided into two sub-sections based on unicellular or multicellular nature of the holdfast.

LITERATURE CITED

LITERATURE CITED

Agardh, C.A. 1812. Algarum, Decas Prima. Lund.

_____. 1817. Synopsis algarum Scandinaviae, adjecta dispositione universali algarum. Lund.

_____. 1824. Systema Algarum. Lund. 312 pp.

Agardh, J.G. 1851. Species Algarum Vol. 2, Part I, Lund. 351 pp.

_____. 1892. Analecta algologica. Lunds Univ. Arsskr. 28:1-182.

Anand, P.L. 1943. Marine algae from Karachi, Part II Rhodophyceae. The University of Punjab, Lahore. 76 pp.

Ardissone, F. 1867. Prospetto delle Ceramiee italiche. Pessaro.

_____. 1883. Phycologia mediterranea, Part I Floridée. Varese.

Ardissone, F. and J. Strafforello. 1877. Enumerazione delle Alghe di Liguria. Milano.

Askenasy, E. 1888. Forschungsreise S.M.S. Gazelle. Part IV Botanik, Algen. Berlin.

Baardseth, E. 1941. The marine algae of Tristan da Cunha. Results Norwegian Sci. Exped. Tristan da Cunha 1937-1938 No. 9. Oslo. 174 pp.

Batters, E.A.L. 1896a. Some new British marine algae. J. Bot. 34:6-11.

_____. 1896b. New or critical British marine algae. J. Bot. 34:384-390.

Batters, E.A.L. 1900. New or critical British marine algae. J. Bot. 38:369-379, pl. 414.

_____. 1902. A catalogue of the British marine algae. J. Bot. 40(Suppl.):1-107.

Børgesen, F. 1902. The marine algae of the Faeröes. Bot. Faröes 2:337-532.

_____. 1909. Some new or little known West Indian Florideae. Bot. Tidsskr. 30:1-19.

_____. 1910. Some new or little known West Indian Florideae, Part II. Bot. Tidsskr. 30:117, 207.

_____. 1915. The marine algae of the Danish West Indies. Part III Rhodophyceae I. Dansk Bot. Ark. 3:1-80.

_____. 1920. The marine algae of the Danish West Indies. Dansk Bot.Ark. 3(6):369-504.

_____. 1923. In C. Skottsberg Marine algae from Easter Island. The natural history of the Juan Fernandez and Easter Island. Bot. 2(3):247-309.

_____. 1924. In C.H. Ostenfeld Marine algae. Dansk. Bot. Ark. 4(7):1-36.

_____. 1927. Marine algae from the Canary Islands, Part III Rhodophyceae I. Kgl. Dansk. Videnskab. Selskab. Biol. Medd. 6(6):1-97.

_____. 1932. Some Indian Rhodophyceae, specially from the shores of the presidency of Bombay. Kew Bull. Misc. Inform. 1931:113-134.

_____. 1933. Ibid, 1933:113-142.

_____. 1937. Contributions to a south Indian marine algal flora, Part I. J. Indian Bot. Soc. 16:1-56.

_____. 1939. Marine algae from the Iranian Gulf, specially from the innermost part near Bushire and the Island Kharg. Danish Sci. Invest. Iran 1:47-141.

_____. 1942. Some marine algae from Mauritius, Part III Rhodophyceae. Kgl. Dansk. Videnskab. Selskab. Biol. Medd. 7(5):1-64.

Børgesen, F. 1952. Some marine algae from Mauritius. Kgl. Dansk. Videnskab. Selskab. Biol. Medd. 18(19):1-72.

Bornet, E. 1904. Deux Chantransia corymbifera Thuret. Acrochaetium et Chantransia. Bull. Soc. Bot. France 51 (Suppl.):XIV-XXIII.

Bory de Saint Vincent, J.B. 1823. Auduinella. Dict. class. Hist. nat. 3:340-341.

Brand, F. 1897. Über "Chantransia" und die einschlägigen Formen der bayrischen Hochebene. Hedwigia 36:300-319.

_____. 1910. Über die Süsswasserformen von Chantransia (D.C.) Schmitz, einschliblich Pseudochantransia Brand. Hedwigia 49:107-118.

Buffham, T.H. 1892. Chantransia trifila, a new marine alga. J. Queckett Micr. Club. 2(5):24-26.

Chemin, E. 1926. Une nouvelle espèce de Colaconema sür Asparagopsis hamifera Okam. Compt. Rend. Acad. Sci. 183: 900-902.

Collins, F.S. 1906. Acrochaetium and Chantransia in North America. Rhodora 8:189-196.

_____. 1908. Two new species of Acrochaetium. Rhodora 10: 133-135.

_____. 1911. Notes on algae. Rhodora 13:184-187.

_____. 1913. The marine algae of the Vancouver Island. Canada Geol. Survey, Victoria Mem. Mus. Bull. 1:99-137.

Collins, F.S. and A.B. Hervey. 1917. The algae of Bermuda. Proc. Amer. Acad. Arts and Sci. 53:1-195.

Collins, F.S., I. Holden, and W.A. Setchell. 1900 and 1909. Phycotheca Boreali-Americana (Exsiccata). Malden, Massachusetts.

Crouan, P.L. and H.M. Crouan. 1860. Liste des Algues marines decouvertes dans le Finistere depuis la publication des algues de ce département en 1852. Bull. Soc. Bot. France 7:367-373.

_____. 1867. Florule du Finistere. Paris. 262 pp., 32 pls.

Crouan, P.L. in H. Maze and A. Schramm. 1870-1877. Essai de classification des algues de la Guadeloupe. Imprimerie du Gouvernement, 2nd ed., Basse terre.

Dangeard, P. 1952. Algues de la presqu'ile du Cap Vert (Dekar) et de ses environs. Botaniste 36(4):193-329.

Darbishire, O.V. 1899. Chantransia endozoica Darbish, eine neue Florideen Art. Ber. deutsch. bot. Gesellsch. 17: 13-17.

_____. 1910. Chantransia sanctae-mariae. A new British species. Northumberland Sea Fish. Comm. Rep. 1909:40-41.

Dawson, E.Y. 1944. The marine algae of the Gulf of California. Univ. So. Calif. Pub. Allan Hancock Pacific Exped. 3(10): 189-453.

_____. 1949. Contributions toward a marine flora of the Southern California Channel Islands, Parts I-III. Allan Hancock Found. Pub. Occas. Paper 8:1-57.

_____. 1950. Notes on Pacific coast marine algae, Part IV. Amer. J. Bot. 37(2):149-150.

_____. 1952. Marine red algae of Pacific Mexico. Part I. Coralinaceae. Allan Hancock Pacific Exped. 17(1):1-240.

_____. 1954a. Notes on Tropical Pacific marine algae. Bull. Southern Calif. Acad. Sci. 53(1):1-7.

_____. 1954b. Marine plants in the vicinity of Institut Oceanographique de Nha Trang, Viet Nam. Pacific Science 8(4):373-481.

_____. 1963. New records of marine algae from Galapagos Islands. Pacific Nat. 4(1):1-23.

De Candolle. 1815 in Lamarck, J.B. de and A.P. De Candolle. Flore Française. 3rd ed. Paris.

Desvaux, A.N. 1809. Plantes trouvées dans le Haut-Piotou, les unes nouvelles, les autres, point indiquées dans la Flore de France. J. Bot. 2:310.

De Toni, J.B. 1897. Sylloge algarum 4(1). Patavii. 388 pp.

_____. 1903. Sylloge algarum 4(3). Patavii. pp. 775-1525.

De Toni, J.B. 1905. Sylloge algarum 4(4). Patavii. pp. 1525-1973.

_____. 1924. Sylloge algarum. Additamenta. 767 pp.

De Toni, G.B. and A. Forti. 1904. Intorno al Byseus purpurea. Atti der Reale Istituto Veneto di Sci., Lettre ed Arti 63:205-210.

Diaz-Piferrer, M. 1963. Adiciones a la Flora Marina de Puerto Rico. Carib. J. Sci. 3(4):215-235.

Dillwyn, L.M. 1809. British confervae, London.

Dixon, P.S. 1961. Algal Species Lists. List of marine algae collected in the Channel Islands during the joint meeting of the British Phycological Society and the Société Phycologique de France, Sept. 1960. Brit. Phycol. Bull. 2(2):71-81.

Doty, M.S. 1947. The marine algae of Oregon. Part II Rhodophyta. Farlowia 3(2):159-215.

Drew, K.M. 1928. A revision of the genera Chantransia, Rhodochorton, and Acrochaetium, Univ. Calif. Pub. of Botany 14(5):139-224.

_____. 1935. The life history of Rhodochorton violaceum (Kütz) comb. nov. (Chantransia violacea Kütz). Ann. Bot. 49:439-450.

_____. 1936. Rhodochorton violaceum (Kütz) Drew, and Chantransia Boweri Murray and Barton. Ann. Bot. 50:419-421.

Durairatnam, M. 1961. Contribution to the Study of the Marine Algae of Ceylon. Fisheries Research Station, Bull. 10, Ceylon. 181 pp., XXXII pls.

Ercegovic, A. 1957. La flora sous-marine de l'îlot de Jabuka. Acta Adriat. 8(8):1-130.

Etcheverry, D.H. 1960. Algas marinas de las islas Oceanicas Chilenas (Juan Fernandez, San Felix, San Ambrosio y Pascua). Rev. de Biol. mar. 10(1):83-132, pls. 6.

Farlow, W.G. 1881. Marine algae of New England and adjacent coast. Washington, D.C. 210 pp. XV pls.

Feldmann, J. 1931. Contribution à la flore algologique marine de l'Algerie. Les Algues de Cherchell. Bull. Soc. Hist. Nat. Afr. Nord 22:179, 254.

_____. 1939. Les Algues Marine de la Côte des Alberes. Part IV. Rhodophycées. Rev. Alg. 11:247-330.

_____. 1954. Inventaire de la flore marine de Roscoff Trav. Stat. Biol. Roscoff, Suppl. 6:1-152.

_____. 1958. Le genre Kylinia Rosenvinge (Acrochaetiales) et sa reproduction. Bull. Soc. Bot. France 105(9/10): 493-500.

_____. 1962. The Rhodophyta order Acrochaetiales and its reproduction. Proc. North Pacific Sci. Congr. 4: 219-221.

Feldmann, J. and G. Feldmann. 1939. Addition à la Flore des Algues marines de l'Algerie. Bull. Soc. Hist. Nat. Afr. Nord 3(8/9):453-464.

Fries, E. 1825. Systema Orbis vegetabilis. Part I Plantae homonemae, Lundae.

Fritsch, F.E. 1945. The Structure and Reproduction of the Algae, vol. II. 939 pp. 336 figs. Cambridge University Press.

Funk, G. 1955. Meeresalgen von Neapel. Publicazioni della Stazione Zoologica di Napoli, Suppl. 25, Naples. 178 pp., pls. 30.

Hamel, G. 1925. Floridées de France, Part III and IV. Rev. Alg. 2:39 et seq.

_____. 1927. Recherches sur les genres Acrochaetium Naeg. et Rhodochorton Naeg. Imprimerie R. Jacqueline, Saint-lo 117 pp. Figs. 47.

_____. 1928a. Floridées de France, Part V. Rev. Alg. 3: 99-158.

_____. 1928b. Sur les genres Acrochaetium Naeg. et Rhodochorton Naeg. Rev. Alg. 3:159-210.

Harvey, W.H. 1833, in W.J. Hooker. The English Flora, Part V. London.

Harvey, W.H. 1836, in J.T. Mackay. Flora Hibernica. Dublin.

_____. 1849. A manual of the British Marine Algae. London.

_____. 1851. Phycologia Britannica, Part III pls. 190-279. London.

_____. 1855. Some accounts of the marine Botany of the colony of Western Australia. Trans. Royal Irish Acad. 22: 525-566.

_____. 1863. Synoptic Catalogue of Australian and Tasmanian Algae. Phycologia Australica, London.

Harvey-Gibson, R.J. 1891. On the development of the sporangia in Rhodochorton rothii Näg. and R. floridulum Näg. and on a new species of that genus. Proc. Linn. Soc. London, Botany 28:201-205.

Hauck, F. 1878. Beiträge zur Kenntniss der adriatischen Algen. Österr. botan. Zeitschr. 8, Vienna.

_____. 1885. Die Meeresalgen Deutschlands und Österreichs. Leipzig.

Heydrich, F. 1892. Beiträge zur Kenntniss der Algenflora von Kaiser-Wilhelms-Land (Deutsch Neu-Guinea). Ber. deutsch. bot. Gesellsch. 10:458-485, 3 pls.

_____. 1893. Vier neue Florideen von Neu-Seeland. Ber. deutsch. bot. Gesellsch. 11:75-79.

Howe, M.A. 1914. The marine algae of Peru. Mem. Torrey Bot. Club 15:1-185, 66 pls.

_____. 1918, in N.L. Britton. Flora of Bermuda, Part IX Algae. New York. pp. 489-540.

_____. 1920, in N.L. Britton and C.F. Millspaugh. The Bahama flora, Algae. New York. pp. 553-618.

Howe, M.A. and W.D. Hoyt. 1916. Notes on some marine algae from the vicinity of Beaufort, North Carolina. Mem. New York Bot. Gard. 6:105-123.

Hoyt, W.D. 1920. Marine algae of Beaufort, North Carolina, and adjacent regions. Bull. U.S. Bur. Fisheries 36:367-556.

Humm, H.J. 1962. Marine algae from the Gulf coast of Texas and Mexico. Pub. Inst. Mar. Sci. 8:227-268.

_____. 1963. Some new records and range extensions of Florida marine algae. Bull. Mar. Sci. Gulf and Carib. 13(4):516-526.

Humm, H.J. and R.L. Caylor. 1957. The summer marine flora of the Mississippi Sound, Pub. Inst. Mar. Sci. 4(2): 228-264.

Humm, H.J. and R.M. Darnell. 1959. A collection of Marine algae from the Chandeleur Islands. Pub. Inst. Mar. Sci. 6:265-275.

Inagaki, K. 1935. Some marine algae recently discovered in Japan and new to Science. Sci. Papers Inst. Alg. Research Hokkaido Imp. Univ. 1(1):41-49.

Israelson, G. 1942. The freshwater Florideae of Sweden. Symboae Bot. Upsaliensis 6(1):1-134.

Jao, C.C. 1936. New Rhodophyceae from Woods Hole. Bull. Torrey Bot. Club 63:237-257.

_____. 1937. New marine algae from Washington, D.C. Papers Mich. Acad. Sci., Arts and Letters 22:99-116.

Joly, A.B. 1957. Contribuicao ao conhecimento da flora ficologica marinna da baia de Santos e Arredores. Bol. da Fac. de Fil., Cienc. e Letras, Univ. São Paulo. 217, Botanica 14:7-199, 10 pls.

Joly, A.B. and M. Cordeiro. 1963. Two new species of Acrochaetium from Southern Brazil. Bol. da Fac. de Fil., Cienc. e Letras, Univ. de São Paulo, 267, Botanica 19:135-140. 2 pls.

Jonsson, H. 1901. The marine algae of Iceland, Part I Rhodophyceae. Bot. Tidsskr. 24(2):127-155.

Kjellman, F.R. 1906. Zur Kenntnis der marinen Algenflora von Jan Mayen. Arkiv. Bot. 5(14):1-30.

Knight, M. and M.W. Parke. 1931. Manx algae. Mem. Liverpool Mar. Biol. Corp. 30:1-155.

Kuckuck, P. 1897a. Beiträge zur Kenntnis der Meeresalgen. Wiss. Meeresuntersuchungen, Abt. Helgoland, N.S. 2(1): 1-46.

_____. 1897b. Bemerkungen zur marinen Algenvegetation von Helgoland, Part 2. Wiss. Meeresuntersuchungen, Abt. Helgoland, N.S. 2(1):371-400.

Kützing, F.T. 1849. Species algarum. Leipzig. pp. 922.

_____. 1861. Tabulae Phycologicae, 1849-71, vols. 1-19, 1200 pls. Nordhausen.

Kylin, H. 1906, in F.R. Kjellman Botaniska studier tillägnade. pp. 113-126.

_____. 1907. Studien über die Algenflora der schwedischen Westküste. Dissertation. Uppsala. 288 pp., 7 pls.

_____. 1925. The marine red algae in the vicinity of the biological station at Friday Harbor, Washington. Lunds Univ. Arsskr. N.F. Avd. 2, 21(9):1-87.

_____. 1928. Entwicklungsgeschichtliche Florideen-studien, Lund Univ. Asskr. N.F. Avd. 2, 24(4):1-127, 64 Figs.

_____. 1930. Über die Entwicklungsgeschichte der Florideen. Lunds Univ. Arsskr. N.F. Avd. 2, 26(6):1-104, 56 Figs.

_____. 1941. Californische Rhodophyceen. Lunds Univ. Arsskr. Avd. 2, 37(2):1-51, 13 pls., 7 Figs.

_____. 1944. Die Rhodophyceen der schwedischen Westküste. Lunds Univ. Arsskr. Avd. 2, 40(2):1-104, 32 pls., 53 Figs.

Kylin, H. and C. Skottsberg. 1919. Zur Kenntnis der subantarktischen und antarktischen Meeresalgen, Part 2. Rhodophyceen. Wissenschaftl. Ergebn. Schwed. Südpolar-Exped. 1901-1903, 4(15). Stockholm.

Le Jolis, A. 1863. Liste des algues marines de Cherbourg, Mem. Soc. Sci. Nat. de Cherbourg 10:1-168, 6 pls.

Levring, T. 1935a. Über einige Meeresalgen bei Kristineberg an der schwedischen Westküste. Bot. Not. 1935:455-463.

_____. 1935b. Zur Kenntnis der Algenflora von Kullen an der schwedischen Westküste. Lunds Univ. Arsskr. N.F. Avd. 2, 31(4):60.

_____. 1937. Zur Kenntnis der Algenflora der norwegischen Westküste. Lunds Univ. Arsskr. N.F. Avd. 2, 33(8): 1-148.

_____. 1940. Studien über die Algenvegetation von Blekinge, Südschweden. Dissertation. Lund.

_____. 1941, in C. Skottsberg, Die Meeresalgen der Juan Fernandz Inseln. 2(22):601-670. Uppsala.

_____. 1942. Meeresalgen aus dem adriatischen Meer, Sizilien und dem Golg von Neapel. Kgl. Fysiogr. Sällskap. Lund Färhandl. 12(3):1-17.

_____. 1945. Marine algae from some Antarctic and Subantarctic Islands. Lunds Univ. Arsskr. N.F. Avd. 2, 41(7):1-36.

_____. 1953. The marine algae of Australia, Part I Rhodophyta: Goniotrichales, Bangiales and Nemaliomales. Arkiv. Bot. 2(6 paper 6):457-530.

_____. 1955. Contributions to the marine algae of New Zealand, Part I Rhodophyta. Ark. Bot. 11, 3(4): 407-432.

Lyle, L. 1920. The marine algae of Guernsey. J. Bot. 58:1-53.

_____. 1929. Marine algae of some German warships in Scapa Flow and of the neighbouring shores. J. Linn. Soc. London, Bot. 48:231-257.

Lyngbye, H.C. 1819. Tentamen hydrophytologiae daniciae. 248 pp., 70 pls. Copenhagen.

Meneghini, G. 1840. Lettera al Dott. Jacob Corinaldi a Pisa.

Miranda, F. 1932. Remarques sur quelques algues marines des côtes de la Manche. Rev. Alg. 6(3-4):275-292.

Montagne, C. 1837. Centurie de plantes cellulaires exotiques nouvelles. Ann. Sci. Nat. Bot. 11(8):345-370.

_____. 1839, in d'Orbigny Flore de Bolivie. Algue Voyage dans l'Amerique Mendionale 7(2):13-39, pls. 1-7.

_____. 1856. Sylloge generum specierumque plantarum cryptogamarum. Parisiis, 498 pp.

Nägeli, C. 1861. Beiträge zur Morphologie und Systematik der ceramiaceae. Sitzber. Akad. Wiss. München 2:297-415.

Nagai, M. 1941. Marine algae of the Kurile Islands, Part II. J. Fac. Agric. Hokkaido Imp. Univ. 46(2):139-310.

Nakamura, Y. 1941. The species of Rhodochorton from Japan, Part I. Sci. papers Inst. Alg. Research Hokkaido Imp. Univ. 2(2):273-291.

Newton, L. 1931. A handbook of the British seaweeds. British Museum. London. 478 pp., 270 Figs.

Papenfuss, G.F. 1945. Review of the Acrochaetium-Rhodochorton complex of the red algae. Univ. Calif. Pub. Bot. 18(14): 299-334.

_____. 1947. Further contributions toward an understanding of the Acrochaetium-Rhodochorton complex of the red algae. Univ. Calif. Pub. Bot. 18(19):433-447.

Petersen, H. 1918. Algae. Rep. of the Danish oceanograph. exped. 1908-10 to the Mediterranean and adjacent seas, 2, K. 3.

Phillips, R.C. 1960a. The ecology of marine plants of Crystal Bay, Florida. Quart. J. Florida Acad. Sci. 23(4):328-337.

_____. 1960b. Ecology and distribution of marine algae found in Tampa Bay, Boca Ciega Bay and at Tarpon Springs, Florida. Quart. J. Florida Acad. Sci. 23(3):222-260.

_____. 1961. Seasonal aspect of the marine algal flora of St. Lucie inlet and adjacent Indian River, Florida. Quart. J. Florida Acad. Sci. 24(2):135-147.

Phillips, R.C. and V.G. Springer. 1960. Observations on the offshore Benthic flora in the Gulf of Mexico off Pinnellas County, Florida. The Amer. Midland Nat. 64(2):362-381.

Pilger, R. 1911. Die Meeresalgen von Kamerun. Engler's Bot. Jahrbücher 46:294-323.

Reinke, J. 1892. Atlas deutscher Meeresalgen, 2. tables 26-50. Berlin.

Rosenvinge, L.K. 1898. Deuxième mémoire sur les algues marines du Grønland Medd. Grønland 20:1-125. Copenhagen.

_____. 1909. The marine algae of Denmark, Part I Rhodophyceae I. Kgl. Dansk. Videnskab. Selskab. Skrifter, Nat. og. Mathem. Af. 7, Raekke, 7(1):1-151.

Roth, A.G. 1800. Catalecta botanica quibus plantae novae et minus cognitae describuntur atque illustrantur 2. Leipzig. 260 pp. pls. 9.

Schiffner, V. 1931. Neue und bemerkenswerte Meeresalgen. Hedwigia 71:139-205.

_____. 1938. Alghe della Laguna, Part I. La Laguna de Venezia, Part III. Venice, pp. 83-250.

Schmitz, F. 1889. Systematische Übersicht der bisher bekannten Gattungen der Floriden. Flora 72:435-456.

Schmitz, F. and F. Heydrich. 1900, in Lauterbach and Schumann (fide de Toni) Flora der deutschen Schutzgebiete inder Suisse. (Euthallophyta).

Setchell, W.A. and N.L. Gardner. 1903. Algae of Northwestern America. Univ. Calif. Pub. Botany 1:165-418.

_____. 1930. Marine algae of the Revillagigedo Islands Expedition in 1925. Proc. Calif. Acad. Sci ser. 4, 19(11): 109-215.

Sirodot, L. 1884. Les Batrchospermes, Paris.

Smith, G.M. 1944. Marine algae of the Monterey Peninsula. 7. Stanford Univ. Press, Stanford, California. 622 pp., 98 pls.

Suhr, J.N. 1831. Beschreibung einiger neuen Algen. Flora 14: 725-731.

Taylor, W.R. 1928. The marine algae of Florida, with special reference to the Dry Tortugas. Tortugas Lab. Carnegie Inst., Washington, D.C. 25:1-219.

Taylor, W.R. 1931. A synopsis of the marine algae of Brazil. Rev. Alg. 5:279-313.

_____. 1937. Marine algae of the northeastern coast of North America. Ann Arbor. 218 pp.

_____. 1941. Notes on the marine algae of Texas. Papers Mich. Acad. Sci., Arts, and Letters. 26:69-79.

_____. 1942. Caribbean marine algae of the Allan Hancock Expedition Rep. 2, 193 pp.

_____. 1950. Plants of Bikini and other Northern Marshall Islands. Univ. Mich. Press, Ann Arbor, XV + 227 pp.

_____. 1957. Marine algae of the Northeastern coast of North America. 2nd ed. (Revised) Univ. Mich. Press, Ann Arbor, 509 pp., 60 pls.

_____. 1960. Marine algae of the eastern tropical and subtropical coasts of the Americas. Univ. Mich. Press, Ann Arbor. 870 pp., 80 pls.

Thuret, G., in A. Le Jolis. 1863. Liste des algues marines de Cherbourg. Paris. 168 pp., 6 pls.

Thuret, G., in E. Bornet and G. Thuret. 1876. Notes algologiques. Part I. Paris.

Tseng, C.K. 1945. New and unrecorded marine algae of Hong Kong. Papers Mich. Acad. Sci., Arts, and Letters 30:157-171, 2 pls.

Van Heurck. 1908. Prodome de la Flora des Algues marines des Iles Anglo-Normandes et des Côtes Nord-Quest de la France. Jersey.

Vickers, A. 1905. Liste des algues marines de la Barbade. Ann. Sci. Nat. ser. 9, Bot. 1:45-66.

Weber-van Bosse, A. 1914. Marine algae, Rhodophyceae, Rep. of the Percy Sladen Trust Exped. to the Indian Ocean in 1905. Trans. Linn. Soc. London Ser. 2, Zoology 16(3):269-306.

_____. 1921. Liste des algues du Siboga, Part II Rhodophyceae. 1. Siboga-Exped. Monogr. 59b. Leiden.

Williams, L.G. 1948. Seasonal alternation of Marine floras at Cape Lookout, North Carolina. Amer. J. Bot. 35(10): 682-695.

Williams, L.G. and H.L. Blomquist. 1947. A collection of marine algae from Brazil. Bull. Torrey Bot. Club 74(5): 383-397.

Yamada, Y. 1932. Notes on some Japanese algae., Part III. J. Fac. Sci. Hokkaido Imp. Univ. Ser. 5, 1(3):109-123.

_____. 1938. Notes on some Japanese algae, Part VIII. Papers Inst. Alg. Research Hokkaido Imp. Univ. 2(1):119-130.

Zanardini, J. 1842. Synopsis algarum in mari Adriatico. Mem. Rep. Acad. Sci. Torino, Ser. 2, 4:105-255.

_____. 1845. Delle Callithamniee e di alcune altre specie del genere Callithamnion. Atti del VII Congr. delgi Sci. Ital. Napoli. Naples.

Plate I

Life cycle of *Acrochaetium dasyae*

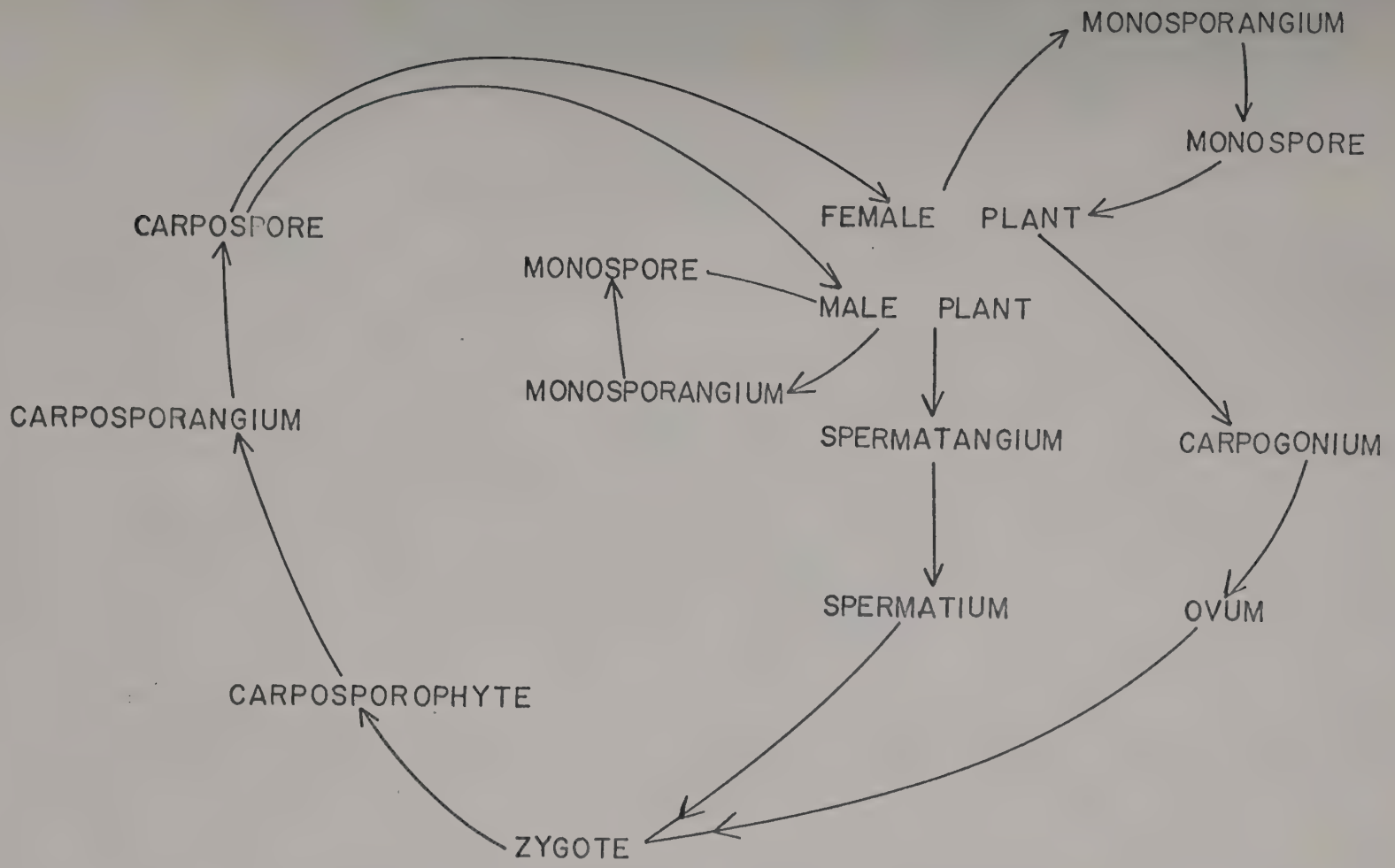

MONOSPORANGIUM
MONOSPORE
FEMALE PLANT
CARPOSPORE
MONOSPORE
MALE PLANT
MONOSPORANGIUM
CARPOSPORANGIUM
SPERMATANGIUM
CARPOGONIUM
SPERMATIUM
OVUM
CARPOSPOROPHYTE
ZYGOTE

Plate II

Figs. 1-16. *Acrochaetium trifilum* X 285

Fig. 17. *Acrochaetium infestans* X 285

Fig. 18. *Acrochaetium hypneae* X 285

Figs. 19-21. *Acrochaetium liagorae* X 285

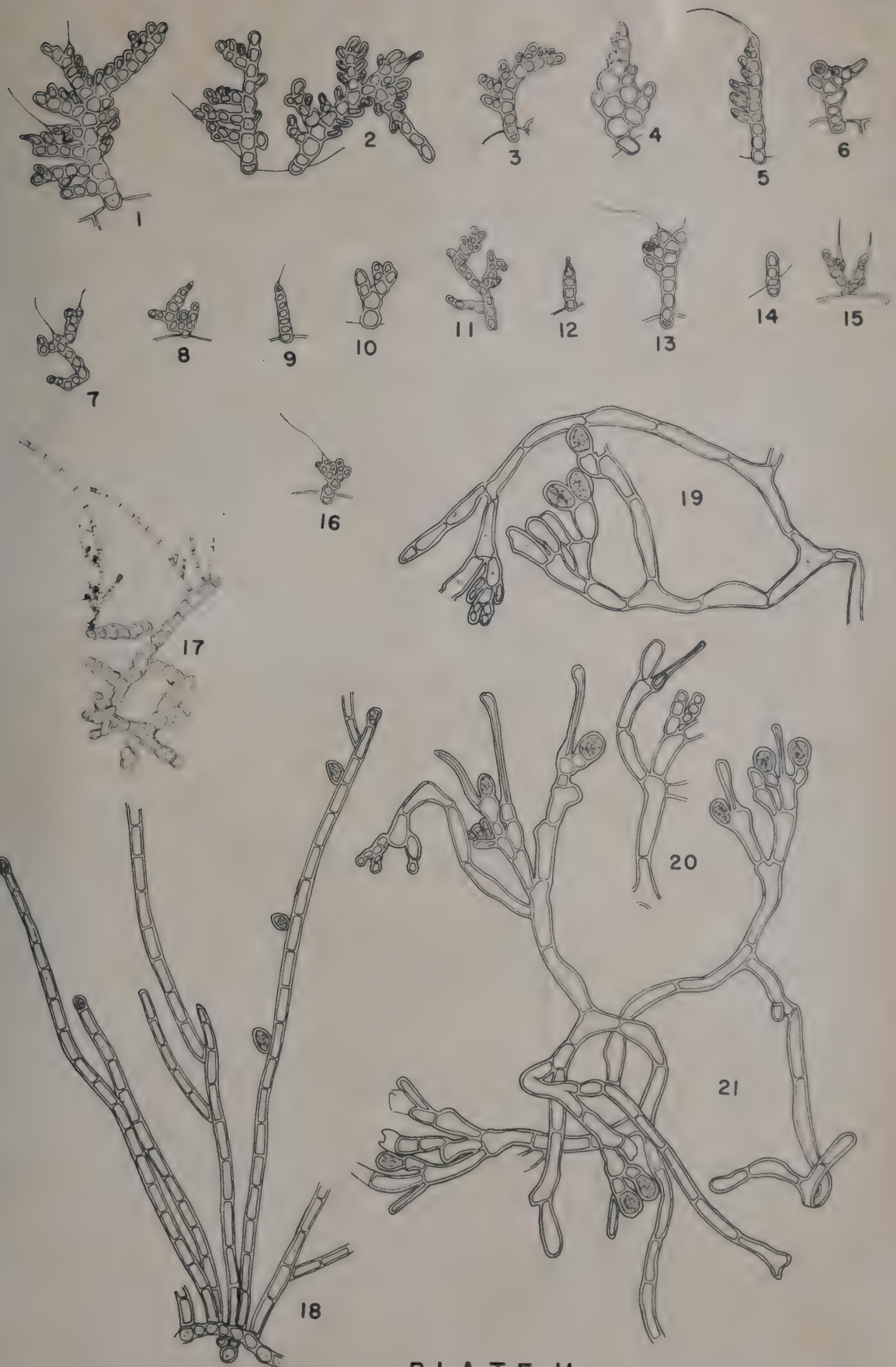


PLATE II

Plate III

Figs. 1-2. *Acrochaetium reniforme* X 285

1. part of erect plant with monosporangia

2. young plant with single erect filament

Figs. 3-4. *Acrochaetium islamii* X 70

Figs. 5-10. *Acrochaetium galaxaurae* X 285

5. monosporangium with a yeast like budding at the tip

6. bisporangium

7. monosporangium

8-9. base of young plants

10. part of a mature plant

Fig. 11. *Acrochaetium alacranense* X 285

Fig. 12-13. *Acrochaetium acanthophorae*

12. habit X 70

13. enlarged view of part of a plant X 285

Figs. 14-15. *Acrochaetium stypopodiae*

14. habit X 70

15. detail of the holdfast X 285

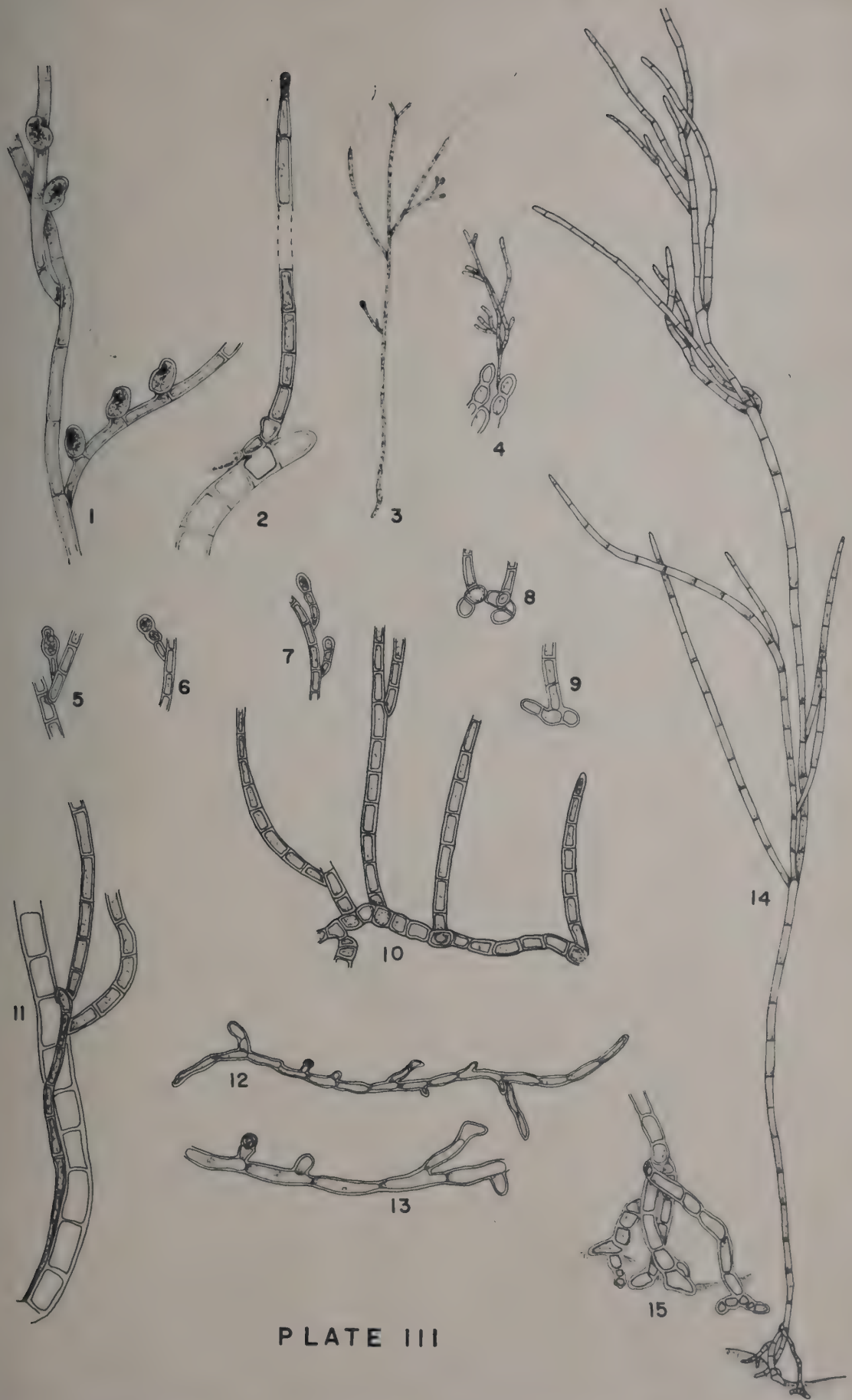


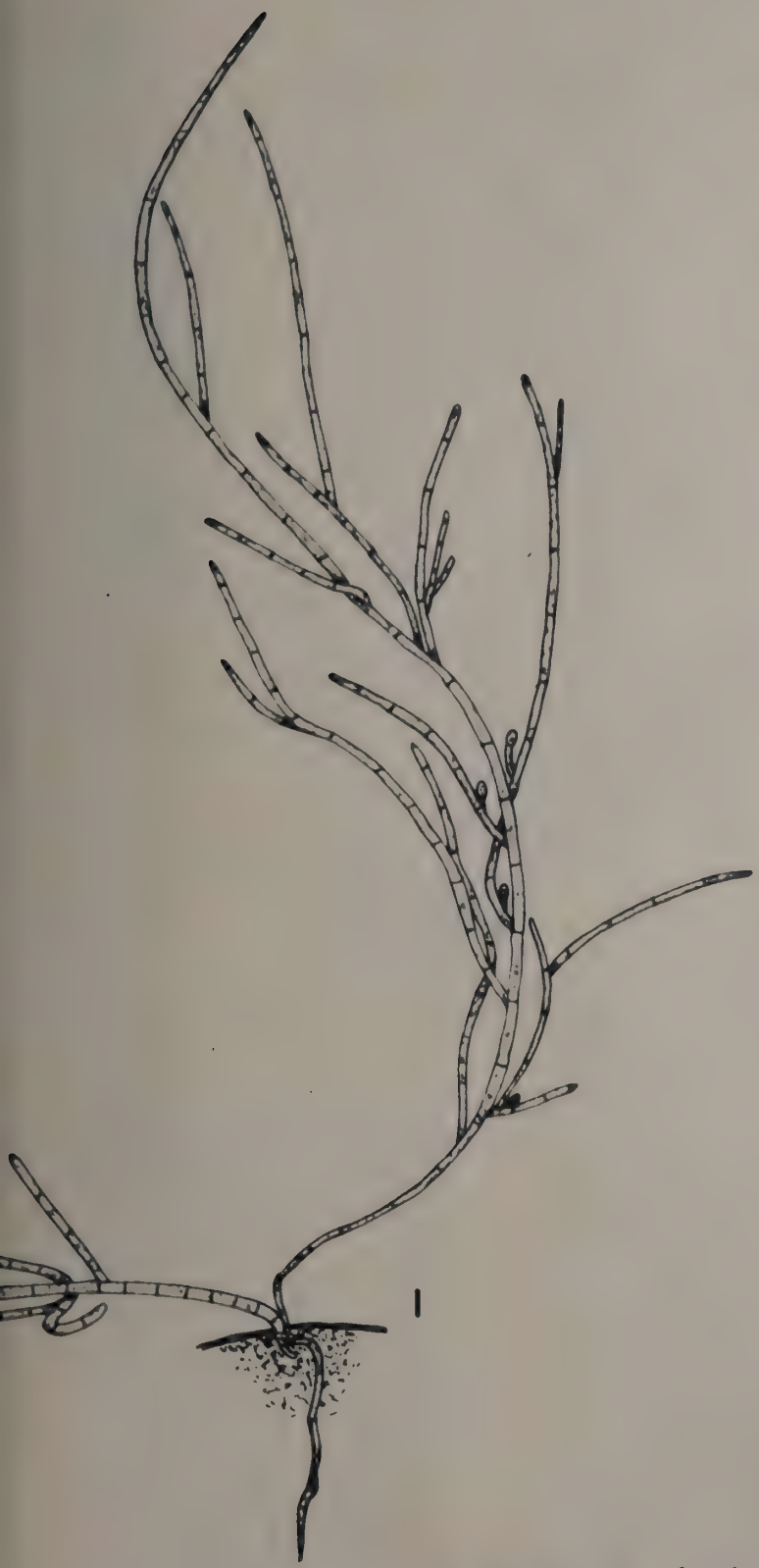
PLATE III

Plate IV

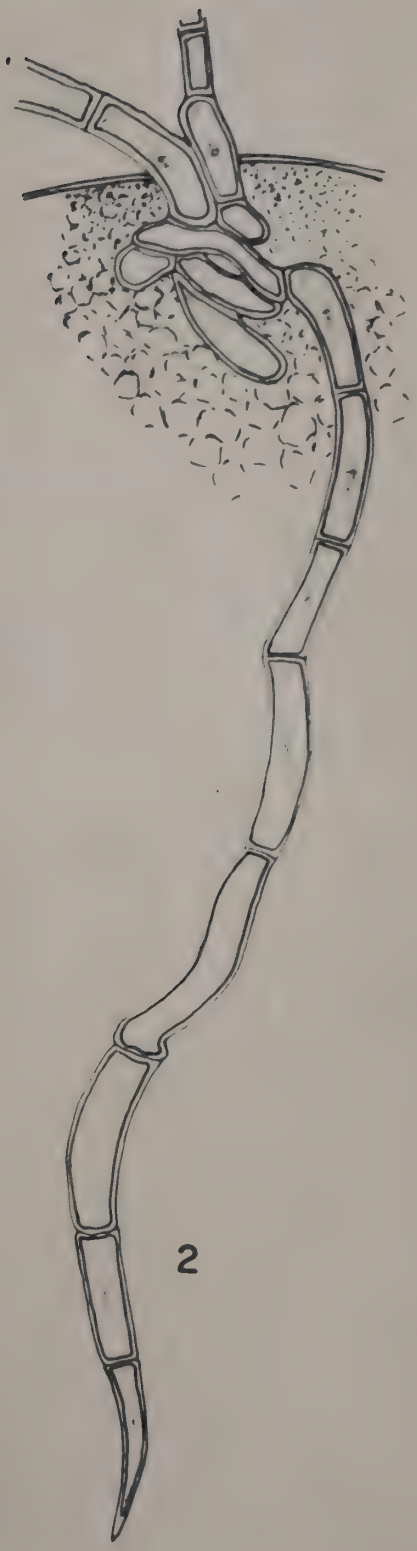
Figs. 1-2. Acrochaetium chondriae

1. Habit of a plant showing two kinds of erect filaments. X 140

2. Basal endophytic part X 570



1



2

PLATE IV

Plate V

Fig. 1. *Acrochaetium sargassi* X 560. The entire plant.

Figs. 2-4. *Acrochaetium chondriae*

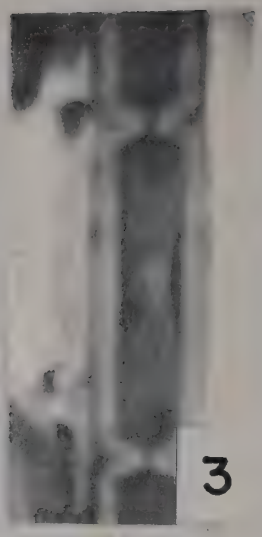
2. part of the epiphytic portion of the plant showing branching pattern and monosporangia. X 715

3. a single cell showing cytoplasmic connections with the neighbouring cells. X 1150

4. endophytic part of a plant with two erect filaments of different sizes. X 665.

1

2



3

4

Plate VI

Figs. 1-2. *Acrochaetium dasyae*

1. female plant with cystocarp and carposporangia X 850

2. habit of plants on the host, a female plant of *Dasya pedicellata*. *A. dasyae* is marked by white arrow. X 12

Figs. 3-6. *Kylinia blomquistii*

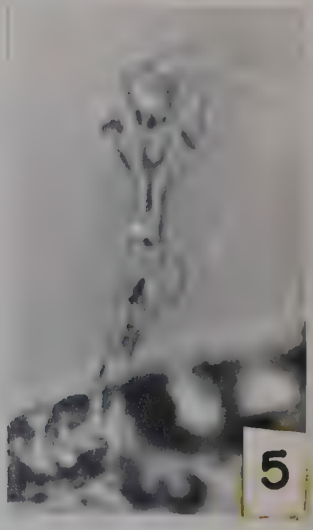
3. a two-celled young plant with the germinating spore attached to the host. X 1600

4-6. male plants bearing spermatangia. X 1250

1

3

4


5

2

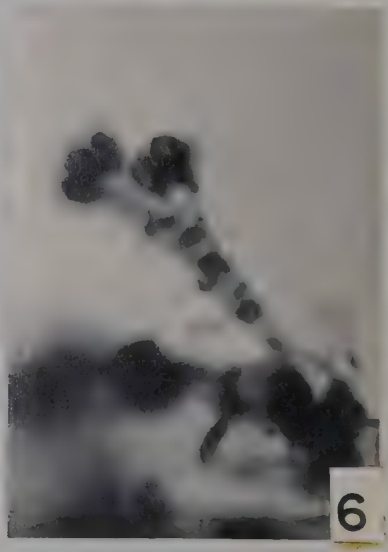

6

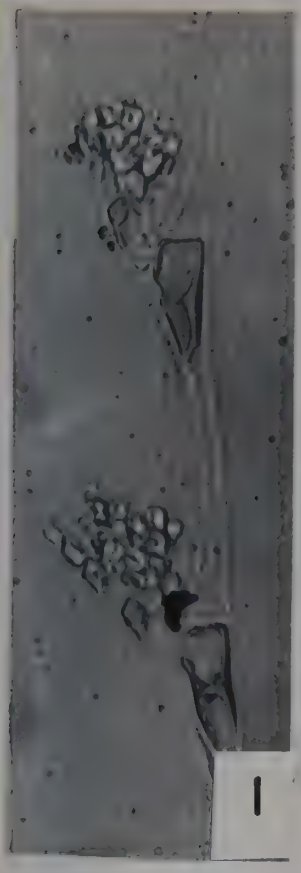
Plate VII

Figs. 1-5. Acrochaetium dasyae

1-4. spermatangial branches

Figs. 1 and 4, X 600, Fig. 2, X 700, Fig. 3 X 750

5. habit of part of a male plant. X 150



1

2

3

4

5

Plate VIII

Figs. 1-6. *Acrochaetium hummii*

1. habit on *Chaetomorpha aerea* X 11

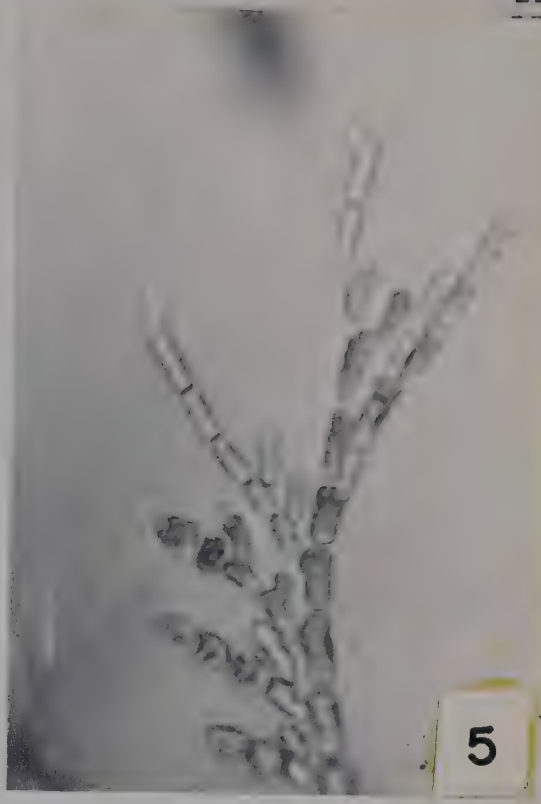
2-4. germinating stages

Figs. 2-3 X 1100, Fig. 4 X 600

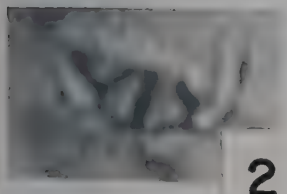
5. terminal part of a branch with hyaline hairs at the tip X 765

6. enlarged view of bisporangia and trisporangia X 1375

1

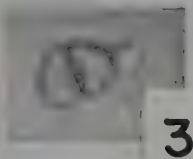


5



2

4



3

6

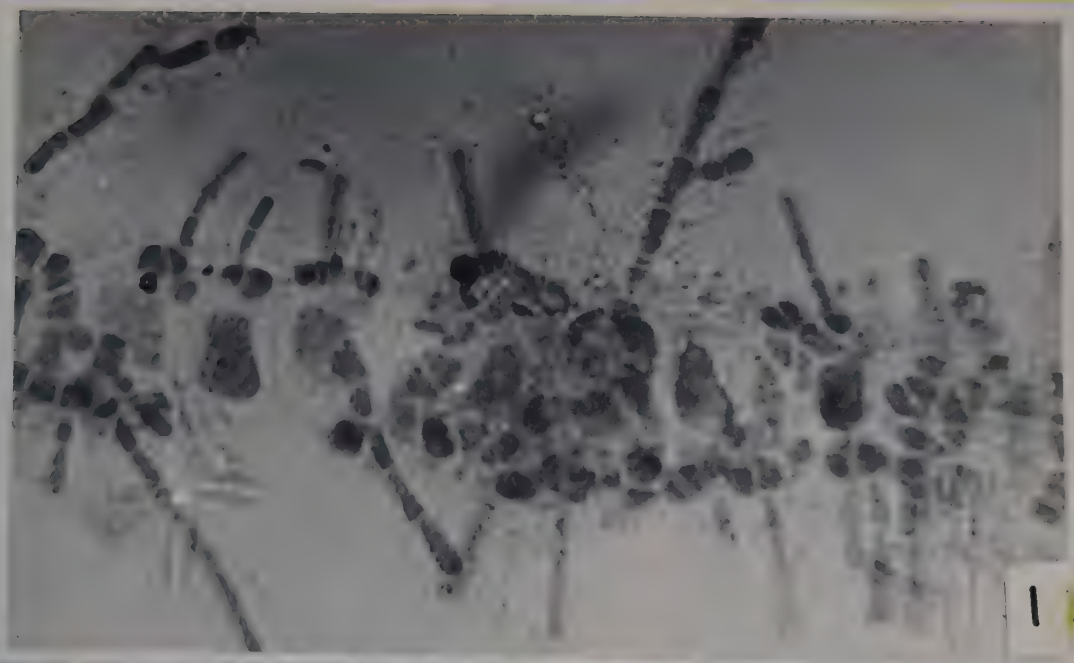
Plate IX

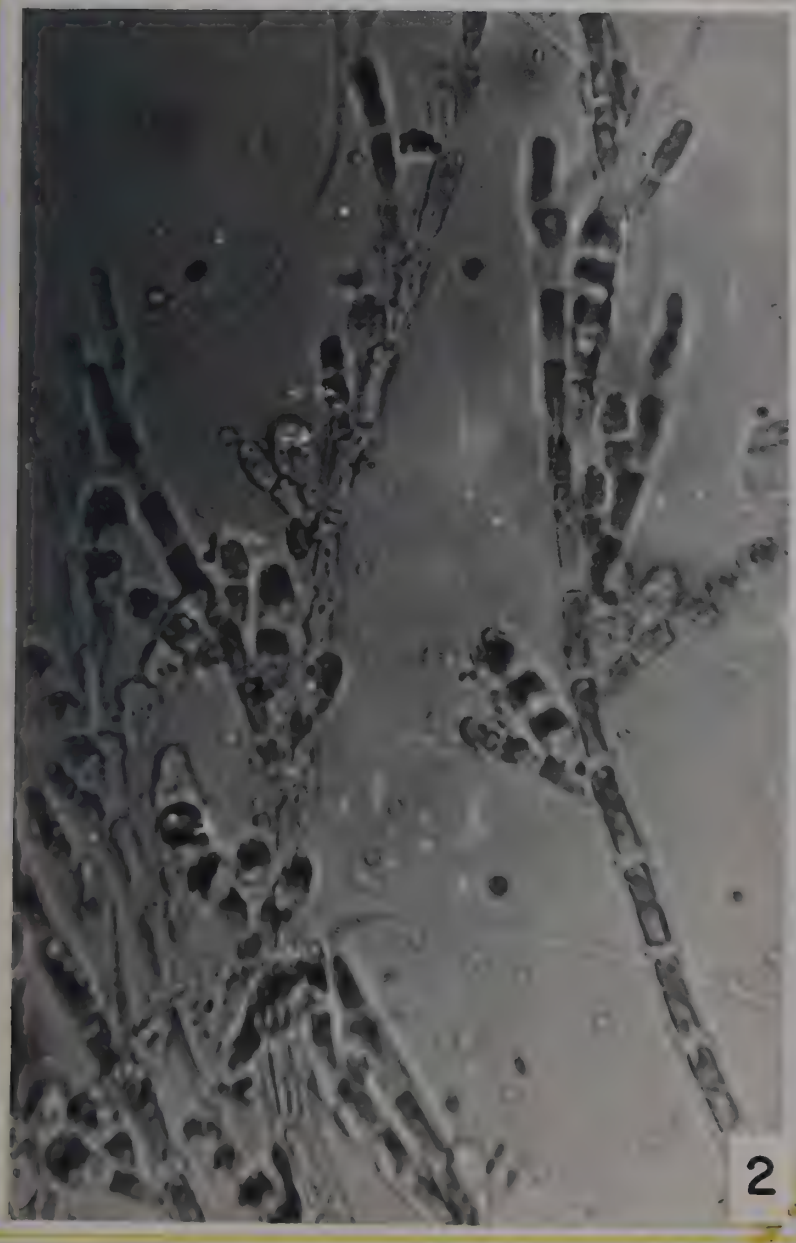
Figs. 1-4. *Acrochaetium hummii*

1. various germinating stages on the wall of *Chaetomorpha aerea* X 600

2-3. several plants on cells of *Sargassum filipendula* X 150

4. enlarged view of the sporangia-bearing part of some plants X 770


1


2

3

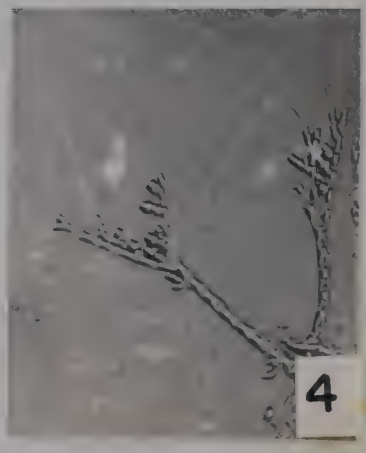

4

Plate X

Figs. 1-2. *Acrochaetium hypneae*

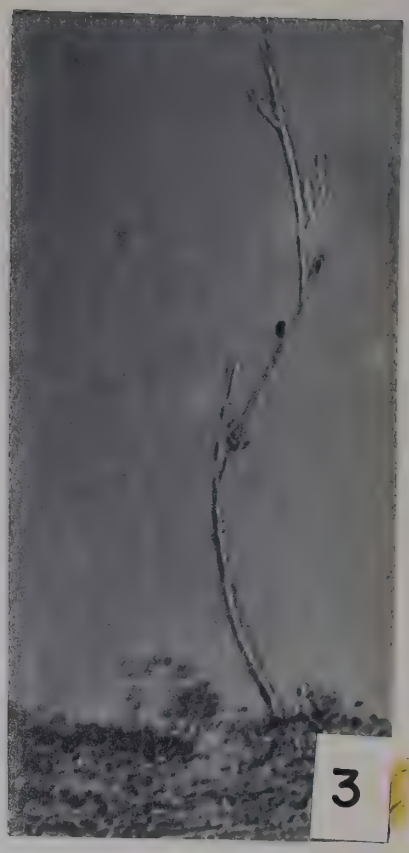
1. habit on *Polysiphonia howeii* X 135

2. enlarged view of lateral and terminal monosporangia X 600

Fig. 3. *Acrochaetium gracile*, habit X 165

Fig. 4. *Acrochaetium hummii*, habit of a plant without terminal hairs X 200

1


3

2

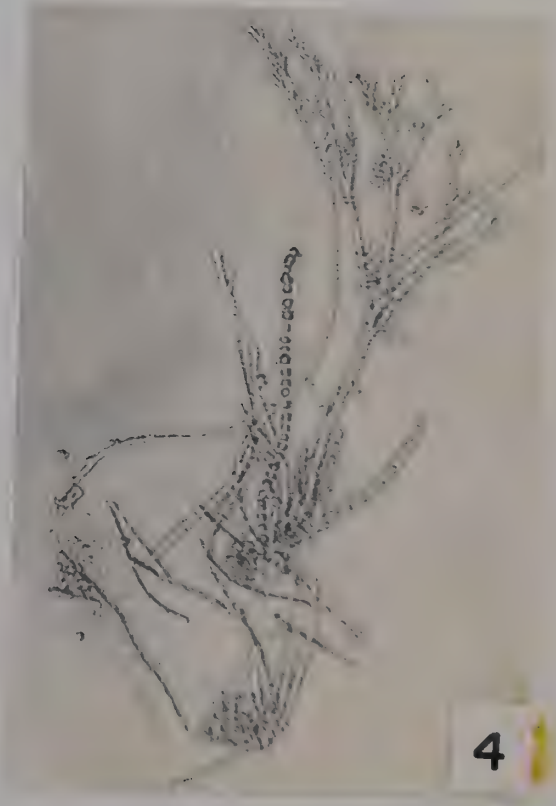

4

Plate XI

Figs. 1-7. Acrochaetium trifilum

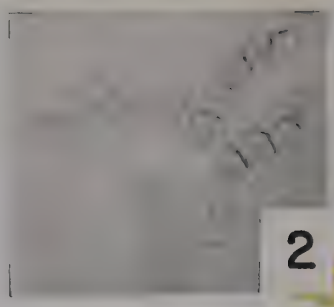
Figs. 1 and 3. X 750

Fig. 2. X 700

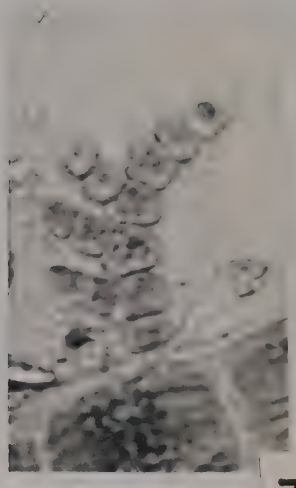
Figs. 4-6. X 550

Fig. 7. X 185

1



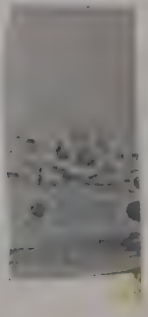
2



3

4

5



6

7

Plate XII

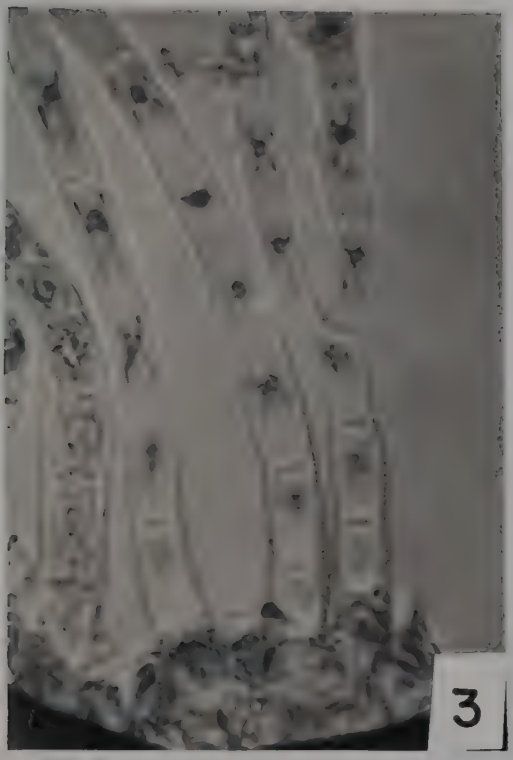
Figs. 1-2. *Acrochaetium sagraeanum*

1. a whole plant (excepting part of the margin) with the holdfast in the center. X 75

2. secund monosporangia. X 850

Fig. 3. *Acrochaetium virgatulum*, part of a plant, showing various kinds of stellate chromatophores in the cells and part of the basal disc. X 650

1


3

2

Plate XIII

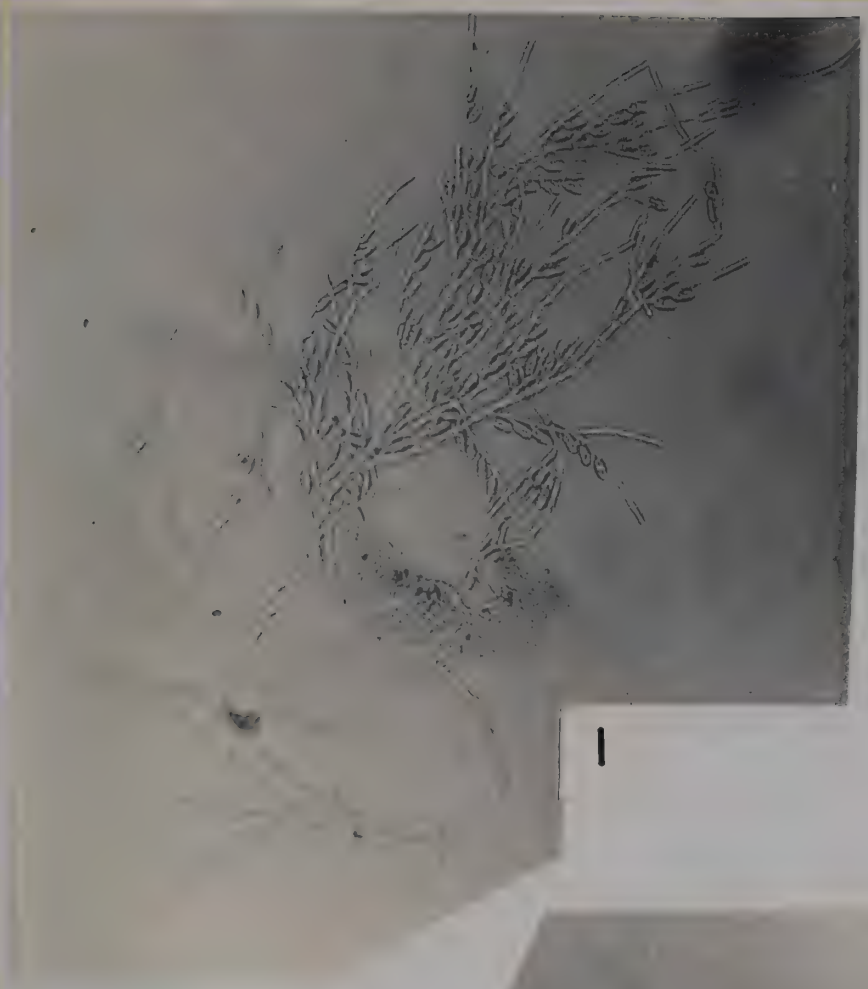
Figs. 1-2. Acrochaetium seriatum X 145

1. a plant with abundant monosporangia

2. a plant with few monosporangia

Fig. 3. Acrochaetium robustum. Unicellular endophytic process indicated by arrow. X 600

Fig. 4. Acrochaetium alcyonidiae. Erect part bearing a cluster of monosporangia, endophytic filament indicated by arrows.



1

4

2

3

Plate XIV

Figs. 1-4. *Kylinia blomquistii*, female plants

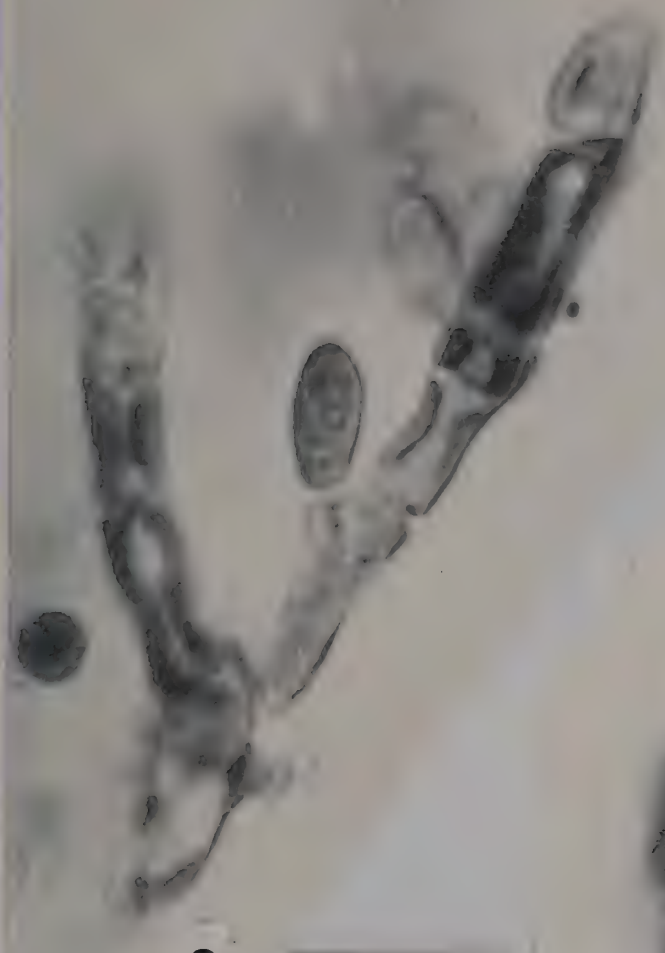
1. germinating stage X 1600

2. original spore bearing two erect filaments, one of them bearing monosporangia X 1600

3. a plant with a terminal hair initial X 1500

4. a plant with a cystocarp, one carposporangium containing a carpospore and three empty carposporangia X 2500

1


2

3

4

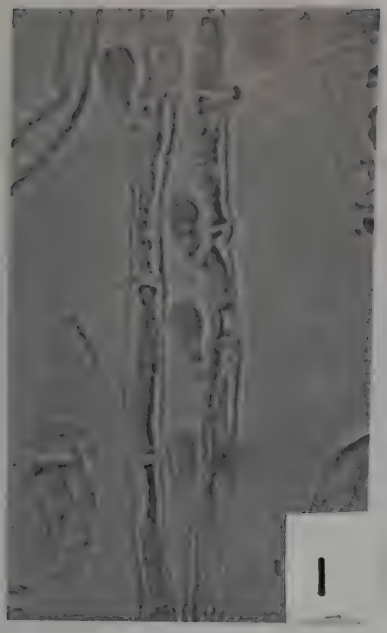
Plate XV

Fig. 1. Acrochaetium alacranensis, part of a plant, showing monosporangia X 625

Fig. 2. Acrochaetium liagorae, part of a plant showing carposporangia and spermatia. Spermatia indicated by an arrow X 580

Fig. 3. Acrochaetium ernothrix. Habit X 100

Fig. 4. Acrochaetium virgatulum, part of an erect filament X 1500



1

2

3

4

Plate XVI

Map showing the known geographical distribution of *Acrochaetium*

WORLD DISTRIBUTION OF ACROCHAETIUM

BIOGRAPHY

Khwaja Muhammed Sultanul Aziz

Born 28th February, 1936, Nabinagar, District Comilla, East Pakistan. Bachelor of Science Degree (with honours), 1956, Dacca University, Dacca, Pakistan. Master of Science Degree (First Class First), 1957, Dacca University, Dacca, Pakistan.

Jobs and awards:

1. Awarded Dacca University Blue (highest award in sports in Dacca University) in 1957.

2. Lecturer in Botany, Dacca University, Dacca, Pakistan, 1957-1959.

3. Fulbright Scholarship, 1959-1960.

4. Teaching Assistantship, Department of Botany, Duke University, Durham, North Carolina, 1960-1962.

5. Assistant in the National Science Foundation Summer Institute for College Teachers, Duke University Marine Laboratory, Beaufort, North Carolina, part of Summers of 1961-1963.

6. National Science Foundation predoctoral fellowship, Duke Marine Laboratory, Beaufort, North Carolina, part of summers of 1960, 1961, and 1963.

7. National Science Foundation fellowship and Institute of International Education travel grant, for attending Summer Institute for College Teachers, in the Oregon Institute of Marine Biology, Charleston, Oregon, part of summer, 1963.

8. Visiting Teacher, North Carolina College, Durham, North Carolina, 1963-1964.

9. Associate Professor of Biology, North Carolina College, Durham, North Carolina, 1964-1965.

Publications:

1. Aziz, K.M.S. and N. Islam. A new species of Fritschiella Iyengar from East Pakistan. Transactions of the American Microscopical Society, vol. LXXXI(2):185-189,April 1962.

2. Aziz, K.M.S. and H.J. Humm. Additions to the algal flora of Beaufort, North Carolina and vicinity. The Journal of the Elisha Mitchell Scientific Society 78(1):55-63, May 1962.

Membership of societies:

1. International Phycological Society
2. American Phycological Society
3. Marine Biological Association of India